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THE HISTORY OF SUGAR AND SUGAR YIELDING PLANTS.

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THE

HISTORY OF SUGAR

AND

SUGAR YIELDING PLANTS,

TOGETHER WITH

AN EPITOME OF EVERY NOTABLE PROCESS OF SUGAR EXTRACTION, AND MANUFACTURE, FROM THE EARLIEST TIMES TO THE PRESENT.

BY

WILLIAM REED.

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1866.

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BIBLIOTHECA · BODLEIANA

PREFACE.

HAVING for many years past been intimately connected with that department of food supply in which Sugar occupies the foremost position, it has occurred to me, more particularly at the time of the agitation on the Sugar Duties, 1863 and 1864, that a small treatise, embodying the finance and distribution, as well as the production of that important article in all its chief varieties, might not be unacceptable to the public. In attempting to accomplish this task, it is evident that an author, in dealing with many parts of his subject, must be content to draw his information at second-hand, from writers who have severally devoted themselves to specific branches. Such has been my case, for the following pages are the analysis and condensation of facts, embodied [illegible] many volumes

and papers that I have consulted on the subject. The accuracy of the statistics may be depended upon, from the fact of their being principally derived from parliamentary papers; which latter reveal an increased consumption of Sugar in this country at the present time, that comparatively few of the public would have imagined. Thus whilst in 1700 the quantity of Sugar consumed in the United Kingdom was ten thousand tons, in 1864 the quantity had increased to nine million seven hundred and thirty-six thousand six hundred and fifty-seven cwts. (9,736,657), or in round numbers 486,833 tons.

The direct purport of the following pages is twofold; viz., (1) to furnish a means of easy reference, whereby the various stages of development the commercial relations of Sugar have undergone, may be traced progressively; (2) to supply an outline sketch of the natural history and the commercial sources of Sugar; followed by notices of the most important processes used for its extraction and refining.

Collaterally, however, it has been thought desir-

able to touch upon certain topics, historical, social, and political, which, through their intimate bearing on Sugar, merit attention. This has been determined by the consideration, that since the first introduction of Sugar to Europe as an article of commerce, it has been associated with conditions of vast magnitude and importance. Thus the insti-institution of negro slavery in the New World, had its origin determined by considerations of Sugar culture. All these phases of the subject I have endeavoured to dispose of, with the relative fulness desirable.

In conclusion it may be permissible to state, that I believe no important particular in relation to Sugar, commercially regarded, will have been omitted.

WILLIAM REED.

5, SUMNER PLACE,
ONSLOW SQUARE.
London, 1865.

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CHAPTER I.

Sugar, its Origin and Earliest Introduction to Various Countries.

Sugar is supposed to have been known at a very early period to the inhabitants of India and China; probably it was also known to the ancient Jews. In several parts of the Old Testament the "sweet cane" is referred to, and it was apparently an article of merchandise coming from a far country.

The sugar-cane was first made known to the western parts of the world by the conquests of Alexander the Great. Nearchus, the admiral sent down the Indus to explore the Indian seas, found it in the East Indies in the year 325 B.C., and describes it as a "kind of honey" growing in canes or reeds.

From India the sugar-cane was introduced into Arabia, Egypt, and the western parts of Asia, and it is occasionally mentioned by several of the early writers. Dioscorides, about the period of the reign of Nero, 35 B.C., is said to be the first writer who

uses the word *Saccharum*, or sugar. He says, "There is a sort of concreted honey which is called sugar, found upon canes in India and Arabia Felix; it is in consistence like salt, and is brittle between the teeth."

In the first century of the Christian Era, Pliny, the natural historian, speaks of sugar as "honey collected from canes," and adds that it is used for medicine only. It appears to have been employed for medicinal purposes alone for many years. Paul Egineta, a physician, 625 A.D., describes sugar as the "Indian Salt," and recommends that a piece be kept in the mouth during fevers. It was also called "Indian Salt" by the Greeks and Romans, who obtained it in small quantities at an enormous cost from India.

At what date the introduction of the sugar-cane into Europe should be fixed, seems to be a doubtful point; but it was certainly known in the Morea, Rhodes, Malta, and Syria before the Holy Wars. There is evidence that it was cultivated in Egypt, around Assouan, as early as the year 766, and that it was first introduced into Sicily between 1060 and 1090. About the year 1108, a Monkish writer, Albertus Agnensis, says that "sweet honied reeds," which were called "*zucra*," were found in great quantities in the meadows about Tripoli. These reeds were sucked by the Crusader's army, who

found much nourishment in them. The same author gives an account of the use of the sugar-canes by the inhabitants of the country. "This plant," he says, "is cultivated with great labour of the husbandmen every year. At the time of harvest they bruise it when ripe in mortars, and set by the juice in vessels till it is concreted in the form of snow, or of white salt. This, when scraped, they mix with bread, or occasionally with water, and take it as pottage." Another historian in 1124 speaks of the juice by the pressure of a screw-engine and concreted by fire, becoming sugar. This is the first account known of the use of heat or fire in preparing sugar. About the same time sugar is mentioned as being made in the neighbourhood of Tyre, and sent thence to the farthest parts of the world.

The sugar-cane was introduced into Spain by the Moors soon after their settlement in the Peninsula in the year 714. By this active and enterprising race the cultivation of sugar was greatly fostered and most successfully pursued; their sugar plantations extending over a great part of the southern shores of Valencia and Granada.

A considerable amount of sugar is manufactured in southern Spain even now. The sugar producing tract lies between the Sierra Nevada and the sea. Its width varies from three to six miles; its length extends to about eighty. The largest concentrated

manufacture is at Almuñecar. Loaves and lumps are not made, the result of manufacture being soft clayed sugar.

It is a moot point whether the sugar-cane be a native of America or the West Indies. Many eminent authors, after investigating this subject with attention, maintain that it is indigenous both to the islands and the continent of America. Labat, a Dominican missionary, supports this opinion with much appearance of truth; and in particular he appeals to the testimony of Thomas Gage, an Englishman, who visited New Spain in 1625. Gage enumerates sugar-canes among the provisions with which the Charaibes of Guadaloupe supplied his ship. "But," continues Labat, "we have surer testimony, and such as proves beyond all contradiction that the sugar-cane is the natural production of America. For, besides the evidence of Francis Ximenes, who, in a treatise on American plants printed at Mexico, asserts that the sugar-cane grows without cultivation, and to an extraordinary size, on the banks of the River Plata; Jean de Lery, a Protestant minister, who was chaplain in 1556 to the Dutch garrison in the fort of Coligny, on the River Janeiro, asserts that he himself found sugar-canes in great abundance in many places on the banks of that river, in situations never visited by the Portuguese. Father Hennegen and other

voyagers bear testimony in like manner to the growth of the cane near the mouth of the Mississippi; and Jean de Laet testifies to its spontaneous production in the Island of St. Vincent. The West India Islands were discovered in 1492, the continent of America shortly afterwards; but let it not be supposed that Europe suddenly became richer on that account in the matter of sugar. There were no breadths of sugar-canes in the West Indies until the Spaniards and Portuguese planted them there. We have already seen that the Saracens introduced the sugar-cane to Spain, and, as already observed, a considerable breadth of canes is grown and sugar extracted in Spain even up to the present time.

Other writers mantain that the sugar-cane was not known in America or the West India Islands till the Europeans transplanted it thither. They assert that about the year 1420 the Portuguese took it to Madeira, in 1503 to the Canary Islands, and in 1510 to the West Indies.

However this may be, it appears by the testimony of Peter Martyr, in the third book of his first decade, composed during the second voyage of Columbus, which commenced in 1493 and ended in 1495, that the sugar-cane was known at that time in Hispaniola.

Without entering too minutely into the gradual development of this important article of commerce,

a few detached facts will sufficiently indicate the changes which the trade in sugar underwent during the fifteenth, sixteenth, and seventeenth centuries.

In 1420, when the island of Madeira was discovered by the Regent of Portugal, he introduced the sugar-cane from Sicily. It was cultivated with success there, as well as in the Canaries, and soon after the sugar of these islands, particularly Madeira, was greatly preferred to that of any other country.

Soon after Columbus discovered the New World, one Pierre d'Etienne took the sugar-cane to Hispaniola, since called St. Domingo, and now Hayti. A Catalonian named Michael Ballestro was the first who expressed the juice from it, and Gonzales de Velosa the first who concentrated this into sugar. The latter built a mill on the river Nigua, and at his own expense, and sent for workmen from the island of Palms (one of the Canaries) to manufacture the sugar. The cane flourished extremely well in St. Domingo, for in 1518 there were twenty-eight manufactories on the island, and the produce was so considerable, that the port duties on the sugar imported into Spain from St. Domingo furnished the funds for building the magnificent palaces of Madrid and Toledo, which were erected in the reign of Charles V.

Antwerp, about 1560, received sugar from Spain, which had it from the Canaries, and also from

Portugal, the latter country deriving it from St. Thomas, and other islands on the African coast, and from Madeira. Sugar was also an article of import from Barbary.

Early in the seventeenth century the sugar trade in the island of St. Thomas appears to have been in a prosperous condition, for the Portuguese had sixty-one sugar works in the island just before the Dutch destroyed them in 1610; and a few years later it is stated that forty ships were annually laden with sugar from this island, for the production of which there were seventy sugar-houses, each employing from 200 to 300 slaves.

In 1641 sugar-canes were transplanted from Brazil to Barbadoes; but the sugar made there was at first so bad, that it was considered scarcely worth exporting, being full of molasses. A few years afterwards, however, valuable information was obtained from Brazil respecting the process of manufacture; from that time the sugar was much improved. In 1650 the British planters in Barbadoes were realizing large profits by the raising of sugar, and in 1676 the trade so increased as to be capable of employing 400 vessels, averaging 150 tons burden.

About the same period that the sugar-cane was transplanted from Brazil to Barbadoes; and probably it was also carried to the Spanish West India

islands; to the Spanish dominions in Mexico, Peru, Chili; and lastly to the French, Dutch, and Danish colonies.

The precise period when sugar began to be used in England is not authentically known. In Marin's *Storia del Commercio de Veneziani* there is an account of a shipment made at Venice for England, in 1319, of 100,000 lbs. of sugar; and during the fourteenth and fifteenth centuries it appears to have been imported in small quantities. As with the ancients, it was at first regarded in this country as only fit for medicinal purposes. When it came to be first employed in sweetening food and beverages, its consumption was inconsiderable, being made use of only in the houses of the rich and great. In 1563 Hawkins, the navigator, brought sugar to England from the island of St. Domingo; but it was not till the introduction of tea and coffee that sugar came into general demand.

Having now traced the steps by which raw sugar was introduced into the different parts of the world, it will be necessary before proceeding further to give a little insight into the history of sugar refining.

Improvements in Sugar Making—Refined Sugar, &c.

The art of refining or crystallizing sugar appears to have been due to the Chinese, who at a very

early period are said to have obtained sugar in the greatest purity under the regular crystalline form, similar to sugar-candy of the present time.

The Saracens seem to have practised the boiling down the juice of the cane to produce sugar in Spain in the eighth century.

The method employed in Arabia and Egypt to clarify the cane juice seems to have been unknown. The merchants who introduced the cane from India certainly neglected to bring also the necessary instructions as to the methods of preparing the juice; and the difficulties which the Arabian cultivators experienced doubtless induced them to try the use of all kinds of ingredients for its purification, and probably to invent conical vessels for cleansing and crystallizing the sugar.

The Venetians are believed to have been the earliest sugar refiners in Europe, whence originated the term "*pains de Venise*," *i.e.*, Venetian loaves, meaning loaves of sugar; and it is said that a Venetian received 100,000 crowns for the invention. This was towards the end of the fifteenth century.

According to Stow's Survey of London, sugar refining was commenced in England about 1544. There were then two sugar-houses in London, but they yielded little profit, because there were many sugar refineries in Antwerp who could supply refined sugar to England better and cheaper than it could

be made at home. Subsequently, the commerce between Antwerp and England being stopped, these two sugar-houses supplied all England for twenty years, and became so wealthy, that many other persons embarked in the business. In 1596 Sir Thomas Mildmay, on the pretext that frauds were being practised in refining sugar, petitioned Queen Elizabeth for a license for an exclusive right to refine sugar for a term of years, for which monopoly he offered to pay an annual sum. His petition was, however, rejected.

Soon after this, sugar refineries were established in all the commercial cities of Europe, and multiplied with a wonderful rapidity, so that this article, which, but a short time before was unknown, became one of the most important articles of commerce.

One of the earliest and most important inventions in connection with the manufacture of sugar, was that of the Clarifier, for the separation of the feculent matter associated with sugar in cane-juice. The merit of this introduction was due to Mr. Samuel Sainthill, and an exclusive patent to secure his claim was granted to him in 1778 by an Act of the Assembly of Jamaica.

About the same time, Mr. Proculus Baker, a barrister of Jamaica, wrote a treatise, in which he suggested a means of ascertaining the proper boiling

heat for sugar. He says: "Provide a small thin pane of clear crown-glass, set in a frame; on this let fall one or two drops of the sugar, and carry it into the open air; observe the subject, and more particularly whether it grains freely, or whether a small edge of molasses separates at bottom."

Dutrone, a French chemist, subsequently introduced great improvements into the art of manufacturing sugar, and his method and arrangements of the building are still adhered to and preferred by some of the most scientific planters.

According to Sir Hans Sloane, the peculiar method of manufacturing clayed sugar was first discovered in Brazil, accidentally, by a hen with clay on her feet going over a pot of sugar, which was found under her tread to be whiter than elsewhere.

In 1823, Mr. James Smith took out a patent for a method of heating boilers by high-pressure steam, which has the advantage of not burning any material submitted to its action; and a few years later another patent of a similar nature was taken out by Mr. William Fawcett, of Liverpool.

In 1828, Mr. J. T. Beale and Mr. G. R. Potter obtained an invention for a new mode of communicating heat.

From this period numerous inventions have been

introduced, and, doubtless, the art is susceptible of still further improvements.

With regard to REFINED SUGAR, one of the most important improvements was that of the Hon. Edward Charles Howard, who in 1812 and 1813 obtained patents for a process of refining and clarifying sugar, and especially as related to the expelling of molasses or syrup from the sugar.

In 1815, Messrs. P. and J. Martineau took out a patent for an improved method of refining sugar. It consisted in employing animal charcoal, which was found to produce a high degree of purity and whiteness. The economy of animal charcoal in the sugar manufacture is so important, that it will be specifically treated of hereafter.

In 1816, Mr. John Hague, of Cable Street, Wellclose Square, took out a patent also for the expelling of molasses. About the same time other methods were invented for expelling molasses without the aid of heat, and Mr. John Taylor obtained a patent for a mode of separating the molasses and other soluble impurities by mechanical pressure.

In 1817 a patent was granted to Mr. Daniel Wilson for certain improvements in boiling sugar. The idea consisted of boiling sugar by means of heated oil, passing through a coil of copper pipe, fixed within the pan containing the sugar. This ingenious apparatus was erected in August, 1819,

by Messrs. Severn, King, and Co., and was worked with great satisfaction and profit for nearly three months, when in November of the same year, a fire broke out which occasioned a loss of £80,000. On the ground that this new mode was more dangerous than the ordinary process of refining sugar, the insurance offices resisted the claim, and a celebrated trial took place, in which one half of the most eminent chemists and scientific men of the day gave evidence diametrically opposite to the other half. The point was decided against the insurance offices, but so dangerous was the process considered, that I believe no refinery has, since then, been constructed on the same principle. The scientific discrepancies on this occasion were so great, that they elicited a merited reprobation on the part of the presiding judge, who remarked that scientific men had done themselves no credit that day. I believe the occasion mentioned was the last when Professor Faraday gave evidence in a court of justice.

In 1828, Mr. Cleland took out a patent for improvements in sugar refining, which wholly applied to the evaporation and concentration of the syrup.

Of recent years numerous other novel applications have been introduced; chief among which are the important improvements [illegible]ced by Dr.

Scoffern in 1849. In reference to these improvements it is proper to remark, that they did not consist in the employment of sugar of lead, but in the separation of sugar of lead employed, infallibly and absolutely.

In the year 1857 sugar was imported in considerable quantities in a state before unknown in this country, under the name of "Melado," as it is called by the Spanish planters of Cuba. It consists of the cane juice defecated and boiled down, when instead of being poured into pans and allowed to separate by granulation into sugar and molasses, and to free itself of the latter by draining, the whole is turned into casks, and in that state shipped. In the course of the voyage the natural separation into sugar and molasses takes place to a greater or less extent, according to the degree to which it has been boiled.

The melado question is very important. There are some who argue that the crystallization of sugar should not be attempted in the localities of its production. They aver that true economy would dictate the concentration of sugar-cane juice into a mere extract (melado), the latter to be dealt with in home refineries. Others have come to the conclusion diametrically opposite:—viz., that if proper appliances of manufacture were brought into use in sugar growing countries, there would be no occasion for

home refineries. In reference to this debate it may be confidently averred that general propositions have been too unhesitatingly laid down. All must depend on special conditions; which vary for each separate sugar-producing region. Balancing the testimony dispassionately, I believe the true averment will be that loaf and lump sugar cannot with advantage be turned out in the Colonies; but, on the other hand, any variety short of loaf or lump could, under a proper application of resources, be more profitably manufactured in the Colonies than at home.

CHAPTER II.

The Principal Sources of Supply of Sugar.

Under whatever aspect viewed, socially, politically, or morally, we may say of sugar, that whether slave grown or otherwise, its importance cannot be too highly estimated. With the exception of actual necessaries of life, no article has grown into such extensive demand; becoming from a positive luxury to almost positive necessary of the present day. The great sources of supply are principally supported by British capital, and the bulk of machinery there employed is the product of British invention and industry; add to these the capital employed in the manufacture of refined sugar in the United Kingdom, and a gigantic investment in one article presents itself not equalled in any other commodity excepting, probably, corn.

The subject of sugar, excepting under the agreeable aspects suggested by a cup of fine *Pekoe*-flavoured *Souchong* or a rich cup of *Mocha*, is rarely discussed by the majority of people. How few

will be able to realise the facts that the consumption of sugar, refined and unrefined, in the United Kingdom during the year 1864 was 9,736,657 cwts., and the net amount of revenue derived from this one article was £5,157,083.

By reference to tables of imports, home consumption, and revenue, which will be found in another chapter of this work, it will be seen how enormously sugar is annually extending. Some politicians assert that, if the duties were "equalised" in lieu of the present "differential," the consumption and revenue would be increased in a ratio much more rapid than any change in duties or extension of commerce has hitherto effected.

The items of historical and commercial importance that I have given of each "principal source of supply" will be, I trust, useful for reference as well as information.

The following brief sketch of the countries which furnish the principal supplies of sugar will afford an idea of the sugar trade of those countries, by showing the quantities of unrefined which have been imported into England during the last ten years.

Antigua.

This is an island belonging to Gr[illegible] in the West Indies, and was discove[illegible]

in 1493. The first settlement was in 1632 by an English family.

There are more than 60,000 acres of land under cultivation, quite two-thirds of which are under sugar plantation.

In 1834 there were 30,000 slaves emancipated, at a cost of £425,866. The Antigua Legislature liberated the slaves at once, without apprenticeship. From the above it will be seen that sugar-cane forms the principal article of cultivation, but the quantity imported during the last ten years does not average 200,000 cwt. annually, and it appears from the imports of last year that sugar production in Antigua is on the decrease. This seeming decadence may be owing to the low prices that had been ruling in 1862-3, which caused planters to turn their attention to other products.

Years.	Cwts.
1855	219,939
1856	203,992
1857	203,802
1858	238,459
1859	196,701
1860	185,586
1861	163,648
1862	258,405
1863	202,483
1864	52,365

Barbadoes, or Barbados.

The most eastern of the Caribbee islands, and the first of the British settlements in those seas. The earliest inhabitants were the Portuguese, who landed in 1600. Five years afterwards the English took possession of the island; and in 1624 the first settlement was made by Sir William Courteen, and the spot fixed upon by him for a residence he named James Town. The leeward part of the island was the first to develop the products of the land. Many of the planters soon became rich, and by the year 1647 the population had risen to 50,000.

Barbadoes has been most disastrously afflicted with fires and hurricanes. In 1675 a frightful storm swept over the island, leaving neither house nor tree standing, excepting the few that were sheltered by some hill or cliff. On the 10th of October, 1780, a hurricane continued with fearful violence for forty-eight hours, causing great devastation. The loss of human life was estimated at over 3000; and the destruction of property amounted to over £1,000,000. A catastrophe of a more appalling nature occurred in 1831, when it was estimated that 5000 persons perished, and the destruction of property was

Barbadoes is highly cultivated and extremely fruitful. Formerly the cultivation of sugar was the only produce upon the island, but for several years past this has formed a portion only of the commerce of the place. Sugar planters have during the past few years much improved their manufacture by the adoption of recent improvements in machinery. In lieu of soft mealy-looking sugar, and heavy *foots*, as they are called by grocers, the bulk now exported is bright hard grain, and some few tons are crystallized almost equal in grain and colour to the finest Berbice or Demerara sugar.

The island covers 106,470 acres, one-fourth of which are planted with sugar-cane.

Barbadoes was the first to yield up the treasures of the earth in the shape of petroleum. The produce of the bituminous springs, of which there are several, has been used for many years—long, long before Pennsylvania was thought of as an oil-producing country—as a substitute for pitch and lamp oil, and also for medical purposes.

The supplies of sugar fluctuate owing to the uncertainty of the crops, occasioned by the hurricanes and bad seasons, as the following table illustrates:—

Years.	Cwts.
1855	592,562
1856	632,442

Years.	Cwts.
1857	583,622
1858	754,235
1859	591,368
1860	647,051
1861	794,117
1862	701,255
1863	649,969
1864	539,706

Bengal Presidency.

This includes several sugar-producing districts, one of the chief of which is Benares. Date Palm is a considerable source of supply in the East Indies: the operation of extracting sugar from it will be treated in another chapter. In 1862-3, the imports of *White Benares* or *Bengal* sugar decreased enormously, owing to grocers ceasing to use them for mixing purposes, for which, on account of their white mealy appearance, they were very suitable; and also the low prices that had been ruling for some time compelled several of the factories to stop work. The final native claying operation, which produces the White Benares, has quite fallen into disuetude in favour of more crystal-yielding pr[illegible]

The territory collectively repr[illegible] and most important division of [illegible]

the exports of sugar to Britain form an important item of its commerce, as follows:—

Years.	Cwts.
1855	446,931
1856	655,413
1857	661,527
1858	463,659
1859	550,126
1860	364,976
1861	419,637
1862	101,006
1863	14,315
1864	481,350

Brazil.

An extensive empire of South America, discovered in 1500, and colonization commenced by the Portuguese in 1531. A large portion of the country is in a wild state; the cultivated portion of the land not amounting to more than a fiftieth part of the whole. The prohibitory duty which was formerly levied upon slave-grown sugar shackled for a time the commerce of Brazil, but since the equalization of duties the imports of Brazilian sugar into this country have more than doubled during the last ten years, as will be seen by the following:—

Years.	Cwts.
1855	468,690
1856	531,207
1857	850,943
1858	836,337
1859	1,118,610
1860	432,979
1861	751,788
1862	1,263,101
1863	1,191,400
1864	1,189,496

CUBA.

One of the most extensive and flourishing islands of Spain. It was discovered by Columbus in 1493, and in 1511 the Spaniards made the first settlement; soon after which the aboriginal inhabitants were totally extirpated. The raising of sugar constitutes by far the most important branch of industry carried on here.

At the present time Cuba represents the process of colonial sugar culture typically as it prevailed in the British colonies during the existence of slavery. It will, therefore, not be inappropriate to state somewhat in detail the economy of a Cuban sugar estate, and the various stages of manufacture.

There are three classes of farms or plantations in Cuba:—the Ingenio, or sugar estate; the Cafetal,

or coffee and orange estate; and the Potrero, or farm devoted to the production of stock, grain, or vegetables. In this place our only concern is with the sugar estate, or Ingenio. Throughout the island of Cuba there are about 2500 sugar estates of varying dimensions. They vary in size from 50 to over 1500 acres. About 150 to 200 acres may be accepted as the average, and generally it is considered that one negro is the proper labour allotment to every two acres. Fewer hands are employed by some planters, but the result then usually is a deterioration of negro strength more than equivalent to the subsistence money saved. A good negro hand is worth in Cuba not less than from 800 to 1000 dollars.

In regard to geological formation, Cuba is evidently of coral origin. Its soil presents two aspects, being either red, like ochre, the predominating colour, or else black; the latter prevailing in the vallies and level tracts. All circumstances regarded, the black land is best adapted for sugar culture, though the Cuban planters do not manifest any partiality for either.

The whole island is amazingly fertile. Year after year the growth of sugar goes on without seeming diminution, no other manure being commonly used than the cane trash or refuse. Exhaustion there is, nevertheless; old estates not producing crops equal

to formerly, though the average produce is kept up by new land taken into cultivation. Many of the estates are over 100 years old; on some of these the canes are becoming short and thin, their saccharine juice weaker than formerly The time will come when these estates will cease to yield sugar at all, except the proper remedy—manure—be applied. For the most part Cuban sugar agriculture is of a very simple kind; a few of the more enterprising planters use the subsoil plough, and other labour-saving machines, but this is not general. Hoes or small surface ploughs are the common instruments for bringing the land into condition. It is argued that if the land were to be ploughed deeper vapours would rise, and cholera would originate, thus imperilling the negroes. How strong this feeling is may be inferred from the following anecdote:—Some years ago, a United States American having an estate in Cuba, imported subsoil ploughs and set them to work. His neighbours remonstrated, and threatened him with a law-suit. He carried his point, however. There was no cholera but an abundant crop, and this result served to dissipate the prejudice in that part of the island.

Much attention is given to the best spot for localizing the sugar buildings. They are situated as centrally as possible with regard to each particular estate, together with their necessary offices,

such as negro houses, cattle sheds, &c. The buildings are usually of stone. The boiling-house is supplied with a chimney from sixty to ninety feet high, so that a powerful draught may be commanded, without which the operation of boiling cannot be carried on. The chimney, indeed, is the most important part of the whole establishment. If too small, or otherwise deficient in power, all comes to a standstill. Steam falls short, and the mill lags; evaporation of the juice is impeded. The consequence may be entire ruin for the season, the fact being always remembered that in the climate of the West Indies cane-juice spoils if left untreated for so much as twenty minutes.

There is much bustle in the sugar-house when crop time arrives; it wears a very animated appearance. The whole concern is overhauled; water is being drawn and stored for constant use in grinding time, cleanliness being the very keystone of success in colonial sugar operations. Engine and mill are being taken to pieces and carefully examined; kettles are cleansed; walls are whitewashed, and the molasses tanks cleansed from thousands of dead rats and cockroaches. At length all having been arranged, the engineer informs the overseer, or "mayoral" as he is called, that grinding may commence. This announcement is made with all solemnity; and a solemn one it is, for the operation of grinding

having once commenced, it must not be intermitted. The *mayoral* has some time ago examined all the cane patches, and arranged in his own mind the order in which they shall be cut. A day is appointed for beginning work, and before it comes the season is one of amusement. The negroes sleep, dance, or beat the gumbo, as may seem to each best. The whites probably gamble, or pass the time at the *baile* or ball. The morning of operations at length comes. With daybreak the mayoral tells off the gangs, each slave armed with a machéte, or cane knife. A string of bullock carts follows the gangs to the fields, to bring the cane to the mill immediately when cut. A negro mayoral, or overseer, heads each gang; he is armed with a machéte more ornamental than those of the rest, and, moreover, carries a stout whip, the better to enforce his authority.

About two-thirds of each gang are armed with machétes, and they fall to work. They seize the canes with the left hand, draw each cane slightly towards them, then cut it close as possible to the root, the lower part of each cane being usually richest in sugar. Each cane is then cut into two or three lengths and these thrown back, when they are gathered up by women and children. Meantime the bullock carts are following; when filled they are taken to the mill, where in Cuba the arrange-

ments are as follow. Under the cane shed is a machine called the carrier; it consists of an endless band or chain, to which boards leading to the feed board of the mill are attached, and so arranged that it can be stopped at pleasure, independently of the mill. The latter consists of three horizontal rollers set triangularly, and all very strongly bound together. The action of these is too evident for description. The cane, after having been subjected to the pressure of these cylinders, comes out a crushed mass, to which the designation of "*bagasse*" is given. This bagasse is delivered upon the floats of an endless chain arrangement, identical in construction with the one just described.

In this manner the process of crushing is allowed to go on, until sufficient juice has accumulated to fill the kettles and clarifiers. Boiling now commences: it is accomplished either by steam or open fire heat, the latter by far the more general plan; I will therefore describe it. The series of open pans in which the evaporation is conducted, taken collectively, is called "the train," the setting of which is subject to variation, though the most general arrangement is as follows: beginning with the flue, which is straight, and from forty to fifty feet long, one extremity of it ends in the great chimney, the other communicates with furnace grate and ash-pit. The flue runs along one of the side walls of

the sugar-house, the mouth of the furnace being outside. The arrangement of the flue is such, that the pans when set rise about two feet above the level of the floor. The arrangement of the pans is linear, corresponding with the flue, all except the two defecators, which stand side by side. In order to heat these, the flue before reaching them is split into three channels, one passing between the two defecators, one on each external side. Dampers are so arranged, that the fire may be turned aside from either flue at pleasure, on the instant; this being necessary, inasmuch as when a crust of vegetable impurity has formed, any prolongation of heat would break it up, and thus prevent its removal by skimming. On the proper setting and efficient management of the defecators depends the success of future operations.

Next come the clarifiers, two iron pans set in brickwork. The second clarifier is a little smaller than the first, to allow for shrinkage of juice by evaporation. After the clarifiers come the evaporators, the first of which is set deep in brickwork, and its size is increased by an upper flange, thus giving room for the copious scum thrown up as the operation progresses. Lastly, and directly over the furnace, where, consequently, the heat is greatest, comes the "*tacho*," or teache, arranged exactly like the preceding vessel, but somewhat smaller.

This description having been given, let us now assume the train at work. Communicating with the juice-tank is a moveable gutter, which, being directed to each pan in succession, charges them with juice. The fire is now lighted, and the train is said to be started. So soon as the juice has warmed up a little, a portion of cream of lime is added, cream of lime being a suspension of lime in water, hence it is stronger than lime-water, which is an actual solution of lime. This cream of lime, called "*temper*," is added according to the sugar master's judgment. He is now, in Cuba, usually guided by the evidence of reddened litmus paper, just as a laboratory chemist would be guided. The object in adding lime is not merely to neutralize vegetable acid, a purpose for which carbonate of lime would be as effectual, and would at the same time be unattended with the danger to which the operator exposes his saccharine juice if he adds a large excess of lime. The special effect which lime has in this operation over carbonate of lime or chalk, is that of coagulating the vegetable albumen present in cane-juice; bringing it to the surface, whence it is removed in the condition of scum. As the heat rises this scum increases, and negroes standing by remove it with a skimmer. The pans nearest the furnace of course boil first, but ebullition soon commences all along the train. As the juice di-

minishes in the teache, or striking pan, it is supplied by ladling from the next vessel, or evaporator. This, in turn, receives juice from the second clarifier, to which the first clarifier ministers, this being supplied from the defecator. In this manner the train is started; but, inasmuch as the pans were all empty at the beginning, the juice has had no regular defecation; the first strike, therefore, does not commonly turn out well. Neither of the defecators has yet come into play, but one of them is now filled from the receiver. Whilst filling, the sugar master tests the juice with litmus paper. This paper is blue, and the blueness changes to red more or less pronounced on coming into contact with any acid. Sugar-cane juice is always acid more or less, and it would be desirable, if possible, to neutralize the acid absolutely. The Cuba sugar master never attempts this; he knowing from experience that a slight excess of acid is preferable to an equivalent excess of lime. He adds cream of lime, therefore, not until the paper reddened by cane-juice changes back to blue again, but until the redness fades back to a faint rose colour. Juice being treated up to this point only requires heat and rest to bring the albumen and many other impurities up to the surface. The defecators are so arranged, that after the train is once started one is always full and the other empty: the latter being cleaned out.

A train being once started, it goes on night and day, with the occasional rest of a day now and then to wash up, clear out the juice tanks and gutters, and effect such repairs as may be necessary. During these intermissions the negroes have a holiday, which they usually devote to sleep.

A few old hands are usually attached to every Cuban sugar estate, who know as much about boiling as any sugar master:—a great deal more, perhaps, than a newly appointed sugar master, a stranger to some particular battery. The diplomacy that then takes place between Sambo and the master is edifying. Some old negro, who may have worked on the estate for twenty years, and who knows all about this particular battery, goes to the teache, when—taking a little of the syrup between his finger and thumb—he draws it out in a thread, and infers from the appearance of the latter that the juice has been boiled enough. Meantime the sugar master is away, though accessible; smoking his cigarette. Sambo tells him the skip is ready; but it would never do for the sugar master to seem to be taught by Sambo. He knows that a few moments will make no practical difference, so he pulls out his watch, and affects to look with much edifying mystery at the dial. At length he lets Pancho, or Pedro, adjust the gutters leading from the teache to the

cooler ten feet away, and the skip of emptying of the teache is effected.

The cooler is a rectangular wooden trough made of deal. The dimensions in Cuba are usually ten feet long, five broad, and ten to twelve inches deep. They are set parallel with the train in a double row, six in a row. Each cooler holds three "strikes," which are not made one over the other directly, but in the following manner. Three strikes are first made in three separate coolers, then operations are recommenced with the first. Whilst the contents of the teache are in the coolers, and cooling, the sugar master takes an instrument like a small rake without teeth, and hauls it up and down so as to agitate the mass, and mingle the forming crystals. No part of the colonial sugar economy has been more questioned than that which refers to the use of these coolers. Instead of promoting the cooling of inspissated sugar juice, it has been argued that means should be taken to maintain the temperature artificially. The limits of this work do not permit me to enter upon the arguments for and against. For these the reader is referred to books that have treated specially on the colonial sugar manufacture.

Drainage.—It has been amply attested by those persons who have given attention to the matter, that heat, however carefully applied to sugar-holding juices, destroys a portion of sugar. The nature of

this destruction is as follows. Sugar—cane sugar —is first changed into a glucose or grape sugar. This is changed into caramel, and a number of dark bodies of acid character, the presence of which gives the darkness to molasses and treacle. The fact is not commonly known that molasses and treacle may be decolorized—bleached, so to speak —yet retaining all its sweetness. I assert the fact, not making any reference to expense: the result can be accomplished, but whether remuneratively is a point that I would not wish to touch upon.

The material taken from the teache, and deposited in the cooler, is a dark brown-looking substance, a mixture of sugar and molasses. The next stage of manufacture consists in digging out the contents of the cooler, and placing them in casks with perforated bottoms. This, in Jamaica, is conducted in what, being translated, is called the "purging-house." The floor of this purging-house consists of joists without boards, a large tank being underneath, into which the molasses drops. After about thirty days the casks are headed up, and either put into the storehouse or at once shipped.

Claying.—It must be here remarked, that the process described is that of making muscovado sugar; if clayed sugar be required, another process is adopted. To practice claying, it is necessary that the concentrated juice be at once turned into

cones of metal or earthenware, instead of the coolers already described. Each cone is put upon its apex, which is hollow, the aperture being stopped either with a piece of wood purposely prepared, or, as is often done, a joint of cane. Sugar to be clayed is boiled a little stiffer than if intended for the cooler. Occasionally the concentrated juice instead of being put into the cones at once, is turned into a wooden box running upon wheels, rather deep and long, in which it is agitated with a short oar for some time, until it has somewhat cooled, and crystals have begun to form; the box being then wheeled up close to the moulds, the latter are filled. In Cuba each mould contains from eighty to one hundred and twenty pounds of hot sugar. Crystallization is allowed to proceed in the moulds until the sugar master considers the operation perfect. He then removes the plugs, when the molasses begin to drain away. The process of claying then commences. Clay being mixed into a sort of mortar with water is turned upon the base of each cone. The clay remains, but the water percolates through, carrying down many of the coloured impurities. This is the process known as claying in Cuba. In English refineries the same process of claying was formerly adopted; the process called claying now does not involve the use of clay at all, but a magma, or mortar,

of sugar and water, to which the term "clay" is technically applied.

Previous to 1809 the ports were closed to foreigners, but in that year they were freely opened, and, as a consequence, the exports have increased with wonderful rapidity. The imports of sugar from Cuba are now much larger than they were ten years ago:—

Years.	Cwts.
1854	1,665,107
1855	731,663
1856	750,340
1857	1,014,469
1858	1,665,785
1859	1,671,115
1860	1,405,087
1861	2,062,717
1862	2,152,508
1863	2,113,687
1864	2,887,795

Dominica.

One of the windward islands in the West Indies belonging to Great Britain, discovered by Columbus in 1493, and ceded to Great Britain in 1763 by France. The supplies of sugar, although not large from this place, are steady; and during the

last ten years have remained almost stationery, until last year, when the imports decreased some thousands of tons. The quality produced is not first class, and very nearly the whole imported is used by refiners.

Years.	Cwts.
1855	55,978
1856	47,041
1857	57,654
1858	60,826
1859	62,550
1860	61,125
1861	66,013
1862	57,442
1863	50,568
1864	40,631

GRENADA.

Another of the West Indian Islands belonging to Great Britain, and discovered by Columbus in 1498 on his third voyage. At that time it was inhabited by Caribs, and the first settlement was in 1650, by Du Parquet, governor of the island of Martinique. There were only three sugar plantations in 1700, and a population of 250 whites and 500 negroes. Grenada was ceded to Great Britain in 1763 by France. The soil is very fertile, and

sugar is readily raised. Imports for the last ten years have been:—

Yeras.	Cwts.
1855	66,981
1856	55,184
1857	90,453
1858	98,768
1859	94,069
1860	91,174
1861	83,498
1862	58,200
1863	90,181
1864	85,384

Guiana (British).

This is a portion of an extensive region of South America, and includes the sugar-growing countries of Berbice and Demerara. The difficulty of procuring manual labour in these districts militates, in a great measure, against the extension of commerce.

Berbice was first occupied by the Dutch in 1626, and by the time that the French effected a landing in 1690, this district of the colony had assumed some degree of importance; on which account the new settlers levied a contribution of 20,000 florins on the population. From that period till 1712, peace and prosperity reigned supreme throughout the di

but was disturbed in that year by an attack from a flotilla of French privateers, who exacted 300,000 florins. This sum was ultimately paid by the firm of Van Hoorne and Co., and they in return exacted an equivalent with interest from the family of Van Peere, to whom three-fourths of this portion of the colony had previously been granted in perpetuity.

The year 1720 will be memorable as long as Berbice remains a sugar producing country; for in that year was raised a loan, by means of shares, for the sole purpose of producing sugar, and from that time to the present Berbice has prospered, and risen to its present position, equalling any country in the world for its production of fine crystallized and semi-crystallized sugars. The colony had a very narrow escape from destruction by the negro revolt of 1763, the opportune arrival of a strong force from Holland quelling what was beginning to take alarming proportions.

A conflagration extending from the river Courantyne to the Demerara, in 1769, spread desolation and want through that portion of the country, particularly in the new sugar plantations, several of which were completely consumed.

Berbice surrendered to the British forces in 1796, but was again restored to Holland by the treaty of Amiens in 1802. The year following it was again taken possession of by the British, and finally ceded

in August, 1814, by the treaty of Paris. Berbice, Demerara, and Essequibo, were in 1831 united under one government called "British Guiana."

The sugar plantations of British Guiana are equal in extent to those of Barbadoes or Jamaica, and the produce is decidedly superior. None of the West India islands manufacture such a bright yellow and crystallized sugar, as either Berbice or Demerara. The cane-juice extracted from the plantations at Demerara is particularly bad, yet it is manufactured into very good sugar, both for refiners' use and for consumption; thus furnishing a striking example of what may be accomplished by science and skill, in triumphing over conditions naturally inauspicious. The soil of Demerara is mostly swampy, hence the juice of canes there grown is heavily contaminated with saline and other foreign matters. Nevertheless the Demerara sugar planter, by liberally bringing to bear the vacuum pan and other scientific appliances, has succeeded in establishing a name for his better class of sugars that is of wide-world celebrity. Here the fact should be mentioned, that the Demerara sugar planters were the first amongst British colonists to employ the vacuum pans.

The imports from Berbice and Demerara were as follow during the past ten years:—

Years.	Berbice. Cwts.	Demerara. Cwts.
1855	85,457	675,636
1856	75,603	596,941
1857	112,745	691,735
1858	95,201	678,625
1859	59,958	736,655
1860	107,122	777,368
1861	124,306	923.796
1862	130,429	873,588
1863	97,939	889,087
1864	99,334	925,993

JAMAICA.

One of the largest and most valuable of the West Indian Islands belonging to Great Britain. The sugar trade of Jamaica was formerly much larger than it is now, and this retrogression is to be traced chiefly to the equalization of duties, which destroyed a monopoly hitherto enjoyed, and opened up a competition in other quarters.

Social Characteristics of Jamaica.

The recent disturbances in Jamaica have invested that island with an interest which makes it incumbent on a writer who treats of sugar-producing colonies to dwell upon that island, its characteristics, and its circumstances, more minutely than with the

others of the West Indian group. Jamaica came into European possession in 1494, having been occupied by the Spaniards, who retained it until June, 1655, when, during the protectorate of Cromwell, it was wrested from them by the English. In Jamaica, as in the other West India islands, the Spaniards soon exterminated the natives, who were found utterly intractable. In vain the Spaniards sought to reduce them to slavery: they preferred death to bondage, and died out accordingly. When the extinction of the natives became imminent, the Count Las Casas proposed the colonization of the islands with enslaved Africans, —a project that, as we know, was speedily carried out. In adverting to this measure of social economy, one out of which such startling issues have been evolved, it is only just to the memory of Las Casas to state that he was a humane man, and that he professed to advocate negro slavery as a measure advantageous to the negro as well as to the white.

When the English wrested Jamaica from the Spaniards, the latter were in possession of negro slaves. Some of these came under our dominion; but others, and the larger number, broke loose from restraint, and, escaping to the mountains, established themselves in fastnesses, from which they could not be dislodged. These runaway slaves

subsequently acquired the name of "Maroons," a term the etymology of which is disputed, but which is generally supposed to be derived from a Spanish word signifying a little pig. In 1796 the Maroons did not number more than 1400, though on several occasions they have proved formidable enemies because of the natural strength of their mountain fastnesses.

To understand the success of Maroon revolts, the physical features of Jamaica must be comprehended. A range of mountains stretches through the island from east to west, in many places inaccessible for all purposes of civilized warfare. To these mountains the runaway slaves escaped, and made good their retreat.

Major-General Sedgwick, in a letter to Secretary Thurloe in 1656, predicted that some day these blacks would prove a thorn in the sides of England. He had no reason to be favourably impressed towards them. They destroyed his men remorselessly when they could, giving no quarter. "Having no moral sense," continued he, "and not understanding what the laws and customs of civil nations mean, we know not how to capitulate or treat with any of them. But be assured they must either be destroyed or brought in upon some terms or other, or else they will prove a great disarrangement to the settling the country."

His predictions were verified. On various occasions the Maroons have given us a great deal of trouble, and, as already remarked, they were not finally reduced to subjection until 1796. The most important treaty established with these people was concluded in 1738. By the provisions of it they received their freedom and a grant of fifteen hundred acres of land. The policy of establishing this isolation was very much doubted at the time. Opponents to the measure argued that the most promising policy would have consisted in endeavouring to amalgamate the Maroons with the general negro population, whereby their extinction as a distinct race might have come about in course of time. This idea was more theoretically advantageous than practically feasible. Inconsiderable though the Maroons were in numbers, the inaccessibility of their mountain fastnesses enabled them to bid defiance to the tactics of regular troops, very much as the natives of New Zealand have been accustomed to do since. Some notion of this difficulty of access may be gleaned from Captain Stoddart's narrative of operations against these people in the campaign of 1734. Having provided himself with some portable swivel guns, he approached with them to the windward Maroon town of Nanny, up a path along which two persons could not go abreast. Captain Stoddart got up

his swivels nevertheless, and, having put them in position, he fired with such effect that many negroes, to escape being shot, precipitated themselves over rocks, thus meeting death in another form.

The difficulties under which operations of regular warfare were taken and prosecuted against the Maroons, explain, though they in no wise palliate, two measures of revolting character that were decreed and brought into execution against them: the first, the subsidizing of Mosquito Indians to make war against them; the second, the hunting them down by bloodhounds imported from Cuba. Both took place in 1737. The Mosquito Indians were formed into companies under their own officers. Each man had £2 monthly, besides shoes and other articles. They followed their own system of warfare, but operated under white guides. In respect to the bloodhounds, Mr. Bryan Edwards is careful to inform the readers of his book on Jamaica, that they were about the size of sheep dogs, and hardly more fierce. If this were so, the animals must have strangely differed from the Cuba bloodhounds of to-day.

One of the conditions of the treaty with the Maroons in 1738 was, that they should not harbour runaway negroes, but bring them back at a fixed price per head; another, that they should turn out as a local militia whenever called upon to do a

The first stipulation they have been usually ready enough to keep, not being desirous of increasing their community by importation, and the head-money being arranged on a scale of liberality. In respect to their qualifications as a militia, the Maroons appear to have co-operated well enough on the present occasion, but in times past their aid was disappointing. The first time they were called upon to act as soldiers, was against some slaves of a certain negro tribe, who had long acquired a character for insubordination, and who ended by taking up arms and putting the authorities at defiance. They escaped to the mountains, and a price was set upon their heads dead or alive. The Maroons turned out in pursuit, and after a few days presented themselves to the magistracy, bearing a lot of black human ears. These they pretended belonged to the runaways, and the tale being credited were paid for them accordingly. The fact was, however, that the runaways had been received into the Maroon community, and the trophy ears had been clipped from dead negroes taken indiscriminately. This was knavish, but the next Maroon performance was ferocious. Having succeeded in capturing the leader of the runaways, he having gone astray in the mountains, and there remained till almost starved, they killed him on the spot, and devoured him all but the head, which latter they paraded

before the authorities, taking credit to themselves for what they considered a meritorious act.

As before remarked, the Maroons on the present occasion seem to have co-operated efficiently with the local authorities, and from this circumstance a writer in one of the daily journals has inferred, that evidence may be seen of the possibility (which had been doubted) of a negro population growing up amidst a white community, and acting harmoniously with the latter. Probably a fuller review of all the circumstances may disturb that satisfactory conclusion. Before the late Maroon co-operation can be indisputably attributed to the prompting of influences which may be spoken of in the aggregate as civilized, two principal circumstances have to be considered: the first, that the breadth of land allotted to the Maroons is circumscribed, thus rendering it inexpedient that the population should be increased by influx; the second, that the Maroons are well paid for all their militia operations.

The history of the Maroon settlement merits careful study at the present time, when so many circumstances conspire to thrust the extra African negro into prominence before the public. If the white races sinned at first in establishing the African slave trade, that sin has drawn down upon itself a visible retribution, which, though painfully felt even now, opens out a prospect of still greater tribulation

for the future. The circumstances of the American war and the Haytian revolution, closely followed by the revolt in Jamaica, have excited the public mind to a degree incompatible with any temperate and unbiassed investigation of the topics in dispute between the negro and the white races. Amongst these topics, the principal is comprised in the question, whether intellectually and morally, as well as physically, the negro possesses endowments and characteristics equal to those of the white races? Whether he be amenable to the general impulses which, operating upon members of the white races, urge them on in the paths of civilization? If issue be joined on those cases wherein independent negro communities have been established, the members of which, being free agents, could act as they pleased, the conclusion will be unfavourable to that opinion which assumes negro equality with the white races. Taking the Maroons as an illustration, these people, notwithstanding their recently manifested fidelity, are seen to be very unfavourable exponents of the negro race. As to religion, they have almost lapsed into heathens. As to morality, it could not well be more impure; and in respect to industry, no more prominent illustration could be found of that laziness, which those who deny the equality of the negro with the white man appeal to as a characteristic of the African race. The question whether the negro

be constitutionally more lazy than the white man, is one that is of the utmost importance just now, for on it turns the verdict of justice or injustice, as regards the ill feeling amongst the negroes of Jamaica which preceded the late lamentable outbreak. On the part of the Jamaica negro constituency, it has been urged that severe taxes have been levied upon them for the purpose of promoting coolie immigration, whereby to keep down the cost of labour; whereas, on the part of the planters, the counter-statement has been, that no dependence could be placed on negro labour to accomplish what was required of it.

As will be remembered, I do not see cause to eulogise the Maroon section of the negro community in Jamaica to the extent that has recently been done; moreover, if such eulogy be justified, it forces a painful conclusion. If the quasi-heathen branch of the negro community dwelling in Jamaica have displayed qualities so much more accordant with civilization than their more ostensibly Christianized neighbours, then of what effect have been the teachings of Christianity?

In respect to the relative proportion of the negro to the white races in Jamaica, the last authentic information is that supplied by the census of 1861. According to that return, the white population was 13,816, being one white to thirty-two blacks or

coloured. Since then some thousands of Indian coolies have arrived, and the white population has gone on decreasing. The total population in 1861 was under half a million, or exactly 441,264. The late outbreak is the fourth great rebellion that has happened in Jamaica. On February 22, 1745, about 900 negro slaves were detected in a conspiracy to destroy all the white inhabitants of the island. In 1795 the Maroons revolted; but the most alarming outbreak occurred on December 22, 1831, when the whole island had to be placed under martial law. The present outbreak has been so recently described in the public journals, that only a general reference to it will in this place be necessary. It commenced in the parish of St. Thomas's-in-the-East, the most easterly and one of the most prosperous in the island. Its estates for the most part have not suffered like those in most parishes of Jamaica. They are nearly all highly cultivated, and labour could always command a fair remuneration. A disturbed state of political feeling has long been prevalent in that parish, and has been combined with one of those strong sentiments of religious exaltation to which the negro temperament is so prone, and which is apt to lead him on to deeds most inconsistent with pure religious teaching. The immediate cause of outbreak was as follows:—On Saturday, October 7, a court

of petty sessions was held at Morant Bay, the chief town of the parish. Amongst the causes to be tried was one of a black boy for assault. As the proceedings went on there were frequent interruptions. Silence was called, but without effect; and the police having seized a man who had created a disturbance, he was rescued by a mob headed by one Paul Bogle, who has since been executed. The native police force then attempted a recapture, but ineffectually. Thus ended Saturday; and on the day following—Sunday—there was a lull. On Monday the issuing of a warrant for the apprehension of Paul Bogle and twenty-seven others for riot and assault brought matters to a crisis. The sickening details of torture and massacre have been so recently narrated, that they need no further reference.

Speciality of Jamaica as regards Sugar production.

The production of sugar varies as to its manner and its various stages, more than that of any other product, according to the physical characteristics of the region that produces it. Means of internal communication, other things being equal, regulate the scale of its manufacture; for, according as the canes admit of being transported, so must the degree of centralization upon particular roots

regulated. The plan has often been advocated, by those persons whose local knowledge of sugar-producing tracts have been small, of separating the agricultural from the manufacturing departments. It has been argued, that nothing can be so inconsistent, and so unpromising of good results, as to turn an agricultural labourer into a manufacturing chemist, as is the case in most of the West India sugar plantations. It would be better, such persons advance, to establish central mills, as corn mills are established in Europe, to convey the canes to these mills; to separate, in point of fact, the agricultural from the manufacturing department. The validity of such recommendations should be tested by specialities, and, more particularly, the specialities of intercommunication. Again, it has been proposed that one model scheme of sugar production having been agreed upon as best, the sugar manufacture of all regions should be in accordance with that scheme; such advice should again be tested with reference to physical characteristics. Jamaica has the advantage of being abundantly supplied with water. Rivers springing from the central ridge of mountains take their course north and south; but, unfortunately, there is hardly a river in Jamaica that can be pronounced navigable. Canoes may, indeed, be floated, and used, as they are used, to convey sugar, but, with very few exceptions, a

craft so large as a barge. Hence, as is evident, the rivers of Jamaica cannot be made available for the transport of a material so bulky as sugar-cane, though they may be taken advantage of to convey in small boats sugar already manufactured to the sea. This circumstance, in the absence of equivalent means of land transport, has necessitated the manufacture of sugar on the estates which grow it, and the scheme of that manufacture within the limits of slight variation may be said to be the same throughout the West Indies.

Crop time, even in the days of slavery, has been described as a period of mingled hard work and hilarity, during which man and beast—animals, even to the swine—grow fat. The work of sugar making from cane juice is most anxious. It admits of no irregularity, no laziness. The crop being ripe will not long wait without deterioration, and the juice once expressed will not keep twenty minutes without fermenting if the proper treatment be not followed. This is a condition that should be well estimated before the West India proprietors are blamed for importing Coolie labour. Sugar is a branch of labour that, more than any other, is incompatible with unsettled relations between master and servant—disputes about remuneration ending in strikes. It is alleged that the freed negroes have taken cruel advantage of this circumstance,

and hence the warrantry for importing Coolie labour at the cost of taxation, against the importation of which negroes have rebelled.

Even in the old times of slavery, the master or estate proprietor was obliged to humour his slaves whilst the sugar boiling season lasted. An experienced boiler was always in great request. Even with the best will on his part, a small error of judgment might work sad ruin; and should he have been spited in any way, he had means at command for taking revenge out of his owner's sugar. A few tablespoonsful of lemon-juice squeezed into the clarifier, or the grand copper, or the striking teache, and the ruin was accomplished. By this simple process the crystallization of the sugar would be almost completely destroyed.

Since the abolition of slavery in the British West Indies, the manufacture of sugar on that island has been conducted in an irregular and slovenly way, very different to formerly. At present the almost military discipline of sugar boiling under slave *régime* is best seen in Cuba; therefore, when treating of that island, an account of it has been given.

The following statement of the causes which have led to the present decadence of Jamaica, appeared in an editorial article of the *Morning Post* of November 22. It is so much to the purpose that I have quoted it entire:—

"The progressive commercial and agricultural decay which has been going on in Jamaica for more than thirty years, is at present spoken of by many who have neither a definite conception of the extent of the ruin, nor knowledge of the causes by which it has been wrought. The degree in which the island at present falls short of its producing powers, can be best understood by the statement of a few facts. In the year 1805, Jamaica exported 150,352 hogsheads of sugar. The present average annual export is only 30,000, or about one-fifth. The crop of 1805 was, however, exceptionally good, so that while we mention it as an example of what the island can produce, we do not wish to contrast it with the present average annual export. That may more fairly be contrasted with the exportation in 1834, which amounted to 88,770 hogsheads. By that time the downward career of the island had fairly set in, having commenced with the rebellion which broke out in December, 1831. During 1832, the area of land in crop was greatly reduced by a large number of sugar estates in the north side of the island being destroyed by the rebellious negroes. We may fairly say that from that date, being four years prior to the total emancipation of the slaves, the influences which have since done so much mischief were unmistakably [illegible]ducing their effects. The falling off in the

exports of rum, coffee, pimento, and ginger has been equally great as in sugar. Along with a diminution in the exports of the island, there has been steadily going on a diminution in the numerical strength, as well as a conspicuous deterioration in the quality of the white population. The most intelligent and well to do part of the white population have year by year been winding up their affairs as best they could, and leaving the island, while their places have been but sparingly supplied by new arrivals. When the last census was taken in 1861, the whites numbered only 13,816 in a gross population of 441,264 white, coloured, and black people. Since that date the whites have rather diminished than increased, while the gross population of the island is supposed to have reached 500,000. The secession of so many of the intelligent and influential whites, and the commercial misfortunes of many of those who remained, has in a twofold manner deteriorated the social status of the governing class. Good men have been entirely lost to the island, and through their retiring inferior men have been raised to positions which they could not otherwise have occupied. It appears, therefore, that the progressive commercial, agricultural, and social decay of the island are intimately dependent on each other. The principal and primary causes of the decay are want of labour and an impracticable

peasantry; but the question still remains, why won't the peasantry—that is, the slaves and the descendants of the slaves who were emancipated in 1838—give a fair day's work for a fair day's wages?

"We believe that this condition of affairs began in the mischievous teaching of the Baptist missionaries prior and subsequent to the 1st of August, 1838, the famous day on which slavery ceased. The bitter disappointment which the friends of emancipation have met with in the issue of that measure, so far as Jamaica is concerned, is chiefly attributable to this cause. The exciting and incautious manner in which the Baptists preached to the negroes, was the immediate cause of the rebellion which broke out in 1831; and many on the gallows sought to extenuate their crimes by referring to the instruction they had received from ministers professing to be Christians. We are very far from saying that the Baptist missionaries directly told, or in their hearts wished, the negroes to murder the whites and burn the estates; but we hold it as proved that such were the effects produced by their reckless language. Eager for emancipation, and still more eager for dollars, they mingled their religious doctrine with the leaven of seditious politics, intemperate denunciations of the slaveowners, and panderings to the weak, the childishly weak, intellect of [illegible] Foremost in this mad and selfish

crusade was the notorious and Rev. Mr. Knibbs, of Falmouth, who, besides drawing a large direct income from the frequenters of his chapel, derived a large additional revenue from a store or general shop which he opened, and for which he was able to secure the patronage of his people. His wife kept a millinery depot for the sable ladies. From these circumstances the pastor acquired the appropriate nickname of 'Maccaroni Knibbs,' and by it he is still well known by Jamaica people. When the slaves became free, the Baptist missionaries, instead of urging the people to work at the wages offered by the planters, fixed a much higher tariff, and organised a strike in support of it all over the island. They told the emancipated negroes to let the canes rot in the ground rather than work for less wages than those fixed for them by their ministers. Too many acted upon this advice. Throughout extensive districts the young plants got choked by weeds from want of labour, and so rotted in the ground. It was thus that the downfall of Jamaica began. It has proceeded from worse to worse. Estate after estate has gone out of cultivation. Others have been sold for a merely nominal price, but the purchasers have nevertheless found their cheap bargains worthless, from want of continuous labour at a favourable rate.

"We have spoken with just severity of the

Baptists in the aggregate; but it is only justice to say that among the followers of that sect there are some worthy and pious people who, along with the religious teachers of all the other denominations in the island, have always honestly and with Christian spirit striven to enlighten the negro in his duty to God and man. We are, however, at present referring to a minority, and to a minority which is not likely to receive many accessions. It has been long ago observed that the most artful and cunning negroes on the estates were chosen as 'elders' and 'deacons.' These men have had great power over the Baptist churches with which they were respectively connected, and, like other and greater men, they have, as power grew, enlarged their ambition. The subordinate offices of 'elder' and 'deacon' ceased to satisfy their inordinate self-conceit; they must needs be full-blown parsons, and 'beat the drum ecclesiastic.' In fine, they separated from the parent society, and set up independent chapels of their own. Paul Bogle, the murderous arch-traitor, was a pastor of one of these independent meeting-houses, and it was within its walls that the rebels, when yet reeking with blood, returned thanks to God for having been permitted to destroy so many white people by fire, and sword, and musket!

"In making these remarks we do not wish it to

be supposed that in the transition stage from slavery to freedom there was nothing reprehensible done except by Baptists. Then and since there have been other evil agencies in operation; but the part played by the Baptist missionaries and their adherents requires that distinctive recognition which we assign to it in the history of the downfall of Jamaica, and the terrible events of last November."

The imports during the past ten years have been, as the following table shows, almost stationary:—

Years.	Cwts.
1855	452,282
1856	371,319
1857	422,772
1858	535,098
1859	428,926
1860	520,808
1861	523,678
1862	553,017
1863	514,557
1864	471,521

JAVA.

An extensive island in the Archipelago. Bantam, formerly the chief city of Java, was the first British possession in the East Indies where they built a factory in 1602. Sugar is one of its staple articles,

and the quality is very good, and used principally for refining purposes. The Chinese carry on the manufacture of sugar in this island to a large and profitable extent. The cultivation has lately been abandoned to a great extent in favour of coffee and cinnamon, which are found more remunerative staples. The imports during the past ten years, as will be seen by the following figures, have fluctuated very materially, and that actually last year none was exported:—

Years.	Cwts.
1855	73,961
1856	8,682
1857	32,133
1858	13,606
1859	124,773
1860	158,739
1861	104,687
1862	53,763
1863	6,754
1864	nil

Madras Presidency.

Another portion of Hindustan, the capital and seat of government being situate on the coast of Coromandel, on the western shore of the Bay of Bengal. The sugar exports for the last ten years

have consisted of crystallized, native yellow, brown, and jaggery, as follows :—

Years.	Cwts.
1855	219,082
1856	460,355
1857	422,175
1858	258,421
1859	283,080
1860	289,034
1861	250,228
1862	207,710
1863	218,566
1864	228,223

Mauritius.

An island in the Indian Ocean belonging to Great Britain, and was discovered by the Portuguese in 1505, who took possession in 1545; but there is no record of their forming a settlement. It was taken by the British in 1810. Sugar is principally the staple of export. Previously to 1825 the sugar imported from the Mauritius to Great Britain was charged with the same duties as that imported from India, but the admission of Mauritius sugar into England on the same footing as those from the West Indies, had the effect of stimulating the sugar trade, and raising it to its present degree of success. Planters and manu-

facturers of sugar on this island complain loudly of a differential scale of duties such as are now levied in England. Many politicians coincide in these views, and own that Mauritius is so impeded by the fiscal anomalies that her efforts to improve are embarrassed and unavailing in ratio to the capital and energy employed. That no colony has imported so much machinery and expended so large an amount of capital for the improvement of the sugar-cane, and the manufacture of its juice into sugar, will be admitted; but that the island is oppressed by fiscal measures to the extent represented, is doubted by those opposed to the equalization of the sugar duties.

In a Letter addressed to *The Grocer* during the agitation of the sugar duties in the spring of 1863 by James Morris, Esq., Representative of the Mauritius Chamber of Agriculture, he thus argued in favour of an equalization:—

"All that the colony asks, is simply that the principles of free trade should be carried out in reference to sugar as they are carried out in other objects of revenue and commerce; that its desire to advance with the scientific progress of the age should not be checked and rendered abortive; while protection is given to a monopoly at home which, *per se*, is a denial [illegible] freedom of the manufacturer in the colo[illegible] Moreover, if the

wishes of any colony—wishes so just and so reasonable as these are—deserve to be listened to by the framers of our laws, and the reformers of our commercial abuses, they are the wishes of the colony of Mauritius: for there this great fact was first practically worked out, and triumphantly established, that free labour could successfully compete with slave labour; and that superior skill and energy, the employment of capital in the erection of the best machinery, and the ready adoption of the researches of modern science, were in themselves sufficient to raise the colony to a high position among the sugar-producing colonies of the world. The specimens of Mauritius sugars at the International Exhibition, 1862, confirmed the truth of the high position the colony occupies; but they also confirmed something more—for they proved incontestably, by a comparison with the sugars from other English colonies, that the best and finest sugars of Mauritius, so much admired and appreciated by the thousands of spectators who beheld them, are banished by an unjust fiscal assessment from the markets of the mother-country, to be carried to other countries which, in the question of sugar at least, do not uphold protectionist doctrine; while the birth-place of free-trade repudiates, in this instance, the freedom of its own commerce, and disfigures and obstructs that policy which has

caused its greatness in recent times, and which has saved it in the hour of its distress."

Mauritius produces annually over 3,000,000 cwt. of sugar, worth between £2,000,000 and £3,000,000 sterling. She exports largely to Australia and France as well as to England.

The annual imports from Mauritius for the last ten years have been as follows:—

Years.	Cwts.
1855	1,363,132
1856	1,647,257
1857	1,184,329
1858	1,086,501
1859	1,169,341
1860	1,163,732
1861	1,504,961
1862	686,433
1863	1,635,671
1864	1,054,429

Mexico.

The agricultural produce of Mexico has hitherto been almost confined to the wants of its population, and the extent of land under cultivation is not equal to one-eighth of the whole area. The production of sugar will be, most probably, in a short time one of its chief branches of industry, for it has been discovered that Mexican sugar-cane possesses

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Puerto Rico, or Porto Rico.

One of the West Indian Islands belonging to Spain. It was discovered in 1493 by Columbus. The Spaniards were the earliest settlers, and for some length of time the natives quietly submitted to them, but ultimately revolted, and massacred great numbers of the invaders. In return, the Spaniards nearly exterminated the race; and from that time to the present the remainder have married and intermixed, that now there is no mark of distinction between the once bitter enemies. It is a fact worthy of note, and highly to be commended, that in Porto Rico the whites work with the blacks in the sugar plantations, and at every other occupation, without that feeling of antipathy which is so generally displayed by one race over the other in the United States and other countries. The resources of this place are wholly agricultural, and the cultivation of the sugar-cane is extensively carried on. The proportion of sugar obtained per acre is much larger and of a better quality than of the other West India Islands. Imports are now twice as large as they were ten years since:—

Years.	Cwts.
1855	239,257
1856	199,724
1857	197,067

Years.	Cwts.
1858	362,734
1859	216,895
1860	262,713
1861	518,635
1862	438,521
1863	545,444
1864	452,219

St. Kitts, or St. Christopher.

One of the West Indian Islands belonging to Great Britain, and one more discovered by Columbus in 1493, who was so pleased with the appearance of the island that he gave it his Christian name. It was the first British settlement in the West Indies, and was taken possession of by a party under Mr. Thomas Warner in 1623. Half of the island is unfit for cultivation; the remaining part is nearly all under sugar plantation. Recent imports are as under:—

Years.	Cwts.
1855	111,785
1856	103,652
1857	91,371
1858	159,256
1859	116,663
1860	165,225

Years.	Cwts.
1861	154,598
1862	186,913
1863	200,691
1864	96,890

St. Lucia.

Another of the British West Indian Islands belonging to the Windward Group, and doing largely in sugar. It is named St. Lucia from the fact of its being discovered on St. Lucia's day, about the year 1635. Soon after an attempt at settlement was made by the English; but they were driven off by the Carribs, who were the only inhabitants at that time. In 1650 a party of French effected a settlement. From that period to 1804 the island was taken and re-taken by the English and French eleven times. Since 1804 it has remained under British possession. The exports to England have been:—

Years.	Cwts.
1855	85,952
1856	61,286
1857	65,970
1858	77,579
1859	82,647
1860	72,940
1861	95,747

Years.	Cwts.
1862	97,367
1863	95,711
1864	85,822

St. Vincent.

One of the West Indian Islands belonging to Great Britain, in the centre of the Windward Group, and was discovered by Columbus in 1498, thus adding another laurel to his wreath. St. Vincent, Barbadoes, and several other islands, were placed under our Government in 1672 by Charles II. By the permission of the natives in 1714 the French commenced settling. It was a point that the English and French continually quarrelled about; but in 1783 it was finally ceded to the British Crown. Like the neighbouring islands, it is fertile in the production of sugar, but the quality does not realize high prices; it is chiefly purchased in England by the refiners.

Years.	Cwts.
1855	98,121
1856	105,936
1857	126,653
1858	146,401
1859	124,475
1860	138,332
1861	135,181

Years.	Cwts.
1862	145,290
1863	136,253
1864	123,346

Tobago.

Another West Indian Island belonging to Great Britain, and discovered by Columbus two years previous to St. Vincent. Few, if any, islands in the Columbian Archipelago can boast of productions so numerous as Tobago, the most valuable of which is sugar-cane. The following are also grown:—coffee, cotton, Indian and Guinea corn, cocoa-nuts, figs, lemons, melons, pine-apples, grapes, bananas, tamarinds, pomegranates, papams, cashew nuts, potatoes, yams, onions, and cassavas. The supply of sugar fluctuates, and never reaches a very large quantity; neither is the quality good.

Years.	Cwts.
1855	39,334
1856	58,583
1857	34,172
1858	67,982
1859	58,501
1860	51,482
1861	55,336
1862	72,303
1863	47,533
1864	44,357

TRINIDAD.

One of the West Indian Islands belonging to the British Government, and, next to Jamaica, the largest and most valuable possession in this part of the world. It was discovered by Columbus in 1498, and he is upposed to have sailed from here to St. Vincent. At that time it contained a numerous aboriginal population. Colonization did not commence until very near one hundred years afterwards, when i was taken possession of by the Spaniards, who held it till 1676, when the French took it, but who in a short time afterwards restored it. The English gained possession in 1797, and have maintained it to the present time. The fertility of this island is remarkable, and sugar is cultivated here to a large extent; and following next in order of cultivation is cocoa, coffee, nutmegs, cinnamon, cloves, tobacco, indigo, and cotton. Vines imported from France and Spain grow to advantage. During the last twenty years our imports from Trinidad have nearly doubled. The progress since 1855 is not so decided, nevertheless there is an increase, and the supplies are in themselves large.

Years.	Cwts.
1855	418,902
1856	483,078
1857 . . . . . -	442,476

Years.	Cwts.
1858	549,626
1859	538,152
1860	530,534
1861	530,012
1862	687,300
1863	600,482
1864	670,793

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CHAPTER III.

Culture and Varieties of the Sugar-cane.

The sugar-cane *(Arundo saccharifera)* varies in height from six to fifteen feet and upwards, and in diameter from one and a half to two inches. The stalk is knotty, with a leaf and an inner joint at each knot, which encloses the germ of a new cane. The outer part of the cane is hard and brittle, but the inner consists of a soft pith, which contains the sweet juice; this juice being elaborated separately in each joint, independently of those above and below it.

The cane is usually propagated by cuttings. The top joints are always selected for this purpose, because they are less rich in saccharine matter than the lower parts of the cane, while the vegetating powers are equally strong. The canes are planted either in holes dug by the hand, or in trenches formed by the plough; in the former case, the ground is marked out in rows three or four feet apart, and in these lines holes are dug of from eight to ten inches deep, and with an interval between them

of two feet. In doing this, the negroes stand in a row, and each man strikes his hoe into the ground immediately before him; he then falls back, the whole row doing the same, and they continue this operation from one side of the cleared land to the other, or from the top of a hill to the bottom. When the plough is used, it is returned along the furrow, so that the earth may be thrown up on each side of the trench.

Two or more slips of cane are laid longitudinally at the bottom of each hole, and covered with earth from the banks to the depth of one or two inches. In about a fortnight the sprouts make their appearance, and then a little earth is put into the hole, and more is occasionally added for four or five months, till the holes are entirely filled up.

The planting of canes does not in the West and East Indies require to be renewed annually. The most general plan is for a certain portion of the land in cultivation to be planted annually, and in succession; the roots and stoles of the former year being left through the remaining parts of the plantation. From these fresh canes, which are called *rattoons*, spring up, and are nearly as large the first year as plant canes. Rattoon canes have a tendency to deteriorate, at least in size, every year during which they are continued; which reason the progressive renewal of the

is adopted. Provided, however, the plants are carefully tended and liberally manured, the same roots will send up canes for twenty years in succession. The rattoons, although not so vigorous as the original plant-canes, afford better sugar, and that with less trouble in clarifying and concentrating the juice. It has been just remarked that in the West and East Indies sugar-canes do not require to be planted annually. A similar observation applies to all parts of the world the climate of which is adapted to sugar-cane culture in a high degree. This plant, however, is grown in regions not naturally adapted to its production, and hence the system of annual planting is necessary. This remark applies to Louisiana, where frost occurring the roots are liable to be killed in winter. Where frost does not occur, rattoon roots will spring year after year for long periods successively. Some rattoon fields in Cuba are over fifty years old. In Louisiana six feet is the distance usually allowed between the cane-rows, in Cuba only four feet. A series of holes is made, each four or five inches deep, and two joints of cane are put in side by side, so that in case one joint fails to germinate, the other may supply its place. The earth is then [illegible] drawn over the slips, and little more except [illegible] is required until crop time.

[illegible]ing of a cane-field is a most laborious

operation when performed, as it must be, under the rays of a tropical sun. Formerly, this task was always effected by land labour; but of late years, where the nature of the ground will permit of the employment of a plough, that implement has been substituted, to the mutual advantage of the planter and his labourers.

The time required for bringing the canes to perfection, varies much under different circumstances; and many planters disregard system as to the time of planting, performing that operation rather at the most convenient than at the most seasonable time. From August to November is, however, generally considered the best time for planting in the British West Indies; and about March and April is, perhaps, the most approved time of cutting the canes, although that operation is sometimes performed through a great part of the year.

The ripeness of the cane is indicated by the skin becoming dry, smooth, and brittle; by the cane becoming heavy; the pith grey, approaching to brown; and the juice sweet and glutinous. The process by which the sugar is elaborated and deposited in the cells of the plant, is one of those inscrutable mysteries of nature which have hitherto baffled the researches of scientific men; but its composition, and the purpose for which it exists in the cane, are clearly understood, being evidently

intended to yield material for the progressive development of the plant during its growth; as when the cane is growing rapidly, its juice contains but little sugar, that substance being required as fast as it is secreted, but when the growth becomes slower as the plant matures, the juice increases in sweetness until it arrives at its maximum density.

The canes, when gathered, are cut as close to the ground as possible, because the richest juice is found in the lower joints; and after reaping them, the usual practice is to cut the stumps down a few inches below the surface of the ground, and to cover them with mould. One or two of the top joints of the cane are cut off, and the remainder are divided into pieces of about a yard long, tied in bundles, and immediately carried to the mill, there to undergo manipulation, the process of which will be found in another chapter. The varieties of sugar-cane are numerous; the longest known is the Creole, or common sugar-cane, which was originally grown at Madeira. It grows freely almost in every region; either in the tropics, in a moist soil, or at an elevation of 3,000 feet above the level of the sea. Another variety is the Otaheitan cane; it was introduced into the West Indies about 1790. This species grows stronger, taller, quicker, has longer spaces between the joints, and is very productive of juice; also grows in lands that are too impoverished

for the ordinary cane to thrive in, and weighs in bulk a third more, yields in juice an excess of one-sixth, and of sugar one-fourth more than the common variety. It yields four crops in the same space of time that the Creole cane raises three. Another cane, valuable chiefly for its hardiness, is the purple-violet. It grows from eight to ten feet high, is covered with a resinous film, which makes it difficult to grind, but the sugar made from it is of excellent quality..

There is a caste in Ceylon called *Jaggeraros*, who make sugar from the produce of the kitul tree. The *Cadjoolie* is a purple coloured cane, yields a sweeter and richer juice than the light coloured cane, but in less quantities; it is not known to the West Indian planter. The *Pooree* is a light coloured cane, and considered by the West Indians as the same species as their own. It is softer but more juicy than the *Cadjoolie*, but less rich, and produces a soft quality sugar, and of little value. The Cullorah is a light coloured cane, and grows to a great height; it thrives in swampy lands, and yields a juice of a watery nature, consequently poor sugar. The China cane is very hardy, and throws out abundant shoots.

The Chinese and African sugar canes, known as the *sorgo* and *imphee*, are the names of sugar-bearing plants or millets: they were introduced to European

notice by Professor Pietro Arduino, of Florence, who attempted to introduce the imphee from Caffreland into Italy, but did not succeed. In 1851, the Count de Montigny, the French consul at Shanghai, sent to France some seeds, and about the same time Mr. Leonard Wray called attention to a plant that was cultivated by the Zooloo Caffres, not for the purpose of manufacturing sugar therefrom, but for chewing and sucking the stalks. He discovered sixteen kinds of imphee, with various degrees of saccharine richness. The plant had been cultivated as a source of sugar in China and Japan from time immemorial. It has a tall straight stalk, and grows from sixteen to eighteen feet high. The seed is formed in the tuft at the top. The soft green pulp undergoes a change of colour as the plant ripens, first becoming violet, then brown, and lastly deep purple, almost black. In this state the maximum of sugar is obtained.

In England both the sorgho and imphee have been tried as crops. The plants grow indeed; but here, the secretion of sugar is altogether insignificant.

CHAPTER IV.

Manufacturing Process of Raw Sugar, chiefly with Reference to Cane-juice.

In order to illustrate the different commercial varieties of this, I had better commence with the state of sugar as it actually exists in the cane. If, then, a length of sugar-cane be cut into thin slices—so thin as to be semi-transparent, admitting of microscopic examination, then, on drying one of these slices at a moderate temperature, and examining it microscopically, minute crystals of *white* sugar may be observed. Now, a question very natural to arise is this:—Inasmuch as sugar actually white can be demonstrated to exist in the cane, how comes it that sugar yellow or brown is sent to us from the colonies? The reply to that question is most easy and most lamentable. In order to extract the sugar from the cane commercially, processes involving the application of heat must be employed, and the nature of sugar is such that heat, at least, a heat far short of boiling,

cannot be employed without altogether altering the nature—in other words, destroying a certain portion of the original sugar. If a portion of moderately rich sugar-cane were handed over to the chemist for laboratory experiment, the chemist would rarely extract less than seventeen per cent. of pure white sugar. Supposing the cane to be very rich, then the quantity of pure white sugar extracted might amount to no less than twenty-three per cent. In commercial practice rarely is more than seven per cent. extracted, and that not in the condition of pure white sugar, but of a yellow or yellowish-brown product, commercially known as muscovado. It would be in vain to scan the records of chemical manufactures to discover a sacrifice so great, and, what is still more to the purpose, there seems very little hope of amelioration. Some years ago a patent was taken out for a process of colonial sugar extraction, that may be almost pronounced chemically perfect. It was proposed by the inventor to slice the canes by machinery, dry the slices by a gentle heat; when dry, to soak out the sugar by warm water, and to finish by careful evaporation of the sweet solution. Chemically regarded, the scheme of operations is almost free from objection. In practice, however, it utterly broke down; and this for reasons that engineers at home would have been slow to imagine.

Most people will, at some time or other of their lives, have had the opportunity of seeing and examining portions of sugar-cane, frequently brought to this country as a curiosity. For the benefit, however, of all such as have not, I may here state that a sugar-cane is only a gigantic grass, differing from our common hay stalks, our barley, wheat, and oats,—all grasses—in being much larger. Now all grasses possess a hard, shining envelope, palpable enough in a common hay-stalk, but far more easy to recognise in a stalk of barley, oats, or wheat. This hard, shining envelope, is nothing else than siliceous or flinty matter. How the flint gets there is not our present purpose to inquire. Enough that it *is* there; no stalk of grass—whether small, like the green material of our hay, or tree-like, as the bamboo—being without it. In proportion as the specimen of grass is larger, so is the flinty coat thicker and harder; and the external coating of the sugar-cane is hard and thick enough to blunt the sharpest knives after very short use. Sugar-cane *cannot* be sliced in any very large quantities: that is to say, commercially; wherefore, had there been no other difficulty, the slicing operation must have commercially broken down. But there was another difficulty, as follows:—To soak the dry slices an abundance of warm water is required; but in many of the sugar colonies, not only water, but fuel is

scarce. In short, the very perfect operation of slicing, drying, and extracting was found to be impracticable.

The usual—all but universal—method of extracting juice from cane is the sugar-mill, in one or other of its many varieties. The sugar-mill consists of iron or steel rollers, sometimes vertically, sometimes horizontally fixed, and between which, closely set, the canes prepared by cutting into pieces of convenient length are made to pass. The waste dependent on this cause is very great: probably, looking at the West Indies in the aggregate, not more than fifty per cent. of juice is extracted out of the ninety per cent. which has been known to exist in the cane.

If the composition of sugar-cane juice were merely a solution of sugar in water, the subsequent stages of manufacture would be most easy; but unfortunately, it is a very complex product. To the eye sugar-cane juice looks exactly like the fluid that may be extracted by bruising and pressure from any ordinary grass of mature growth—green, turbid, and having the ordinary vegetable smell. Poured from one vessel to another, it suggests the idea of being thin, an idea hardly compatible with the enormous bulk of material that may be coagulated by heat and thrown up, just as white of egg is coagulated and thrown up when poured [illegible] boiling

water. Not only is this material suggestive of white of egg albumen, but it differs very little, if at all, in composition from that substance: hence the propriety of the term—"vegetable albumen," commonly applied. A considerable portion of the impurities associated with sugar in sugar-cane juice may be separated by heat alone: not the whole, however. To effect a total separation, or more properly speaking such an amount of separation as will permit the crystallization of sugar, it is absolutely necessary that some chemical agent be applied. Lime is commonly used for this purpose, and the utmost possible care is required that an unnecessary excess of it be not used. Employed for this purpose the lime is called "temper," and the operation of using it tempering. No sooner is the temper lime added at a heat far short of boiling, than the original green colour of the juice changes to yellow or yellowish, and an enormous amount of impurities being thrown up, is skimmed off.

The evaporating operation is now commenced. Flame from the burning megass or cane refuse, rushes along under a series of copper pans, each containing cane juice in a successive stage of evaporation. The coppers decrease in size, and are arranged in such a manner that the smallest holds the thickest or most evaporated juice. As the water evaporates away, the thickened juice is re-

moved by ladling to the adjoining pan, until proceeding in this way, at last the extreme or smallest vessel is arrived at. Great experience on the part of the operator is necessary that the juice—now a syrup—may not remain too long in this pan. The indications that the boiling has been sufficiently prolonged can only be learned by experience, and are far too numerous for mention here. At length the thickened juice is turned out into a shallow wooden vessel, termed a "cooler," and here the material is allowed to set, resolving itself into a mingled mass of crystalline sugar, and sweet uncrystallized matter, to which the term "molasses" is commonly applied.

The next process consists in separating the molasses to some extent. Not only else would the material not bear carriage, but it would not come to market in the state which the grocer requires. The molasses is usually separated in a very primitive way. The material as it comes from the cooler being put into casks, the holes in the latter are loosely closed with plantain leaves, in such a manner that a rough sort of strainer is extemporised. Through this strainer the molasses is designed to pass, and in the cask the sugar is designed to remain; but the apparatus and mode of conducting the operation are both so imperfect that the result aimed at is very inadequately achieved.

Such is the ordinary scheme of sugar manufacture, pursued in the British West Indian Colonies. On certain estates, few and far between, other appliances are brought to bear, but they are by no means general. Filtration through animal charcoal and vacuum boiling have of late years been adopted by some colonialists.

The crystalline product of the series of operations just described is called muscovado, or raw sugar. Though it is a compound of white sugar with impurities added, nevertheless these impurities are not offensive to the taste or smell; in which respect raw cane-juice sugar differs from raw maple, date, and beet-root sugar.

Very nearly allied to muscovado sugar is the commercial sort known as clayed sugar. One hundred parts by weight of green sugar-cane are made up of ninety parts sap and ten parts of woody fibre and foreign materials, to which latter may be given the designation of "natural impurities." In different colonies the manufacture varies a little, but in all essential particulars the scheme is identical.

According to variations of soil, so are different foreign materials taken up, the result being variation of product. Now, despite the utmost exertions of the colonial manufacturer, he cannot remove the whole of these extraneous matters; hence they

affect the quality of the sugar directly by their presence, and indirectly by destructive changes which they cause in the sugar. Generally speaking, an excess of natural impurities tends to lessen the crystalline power of sugar, thus begetting small soft grain; but whether the grain shall be hard or soft, small or large, depends to a great extent on the manner of boiling. A very inaccurate complexion of thought is begotten by the common use of the vague term *saccharine matter*. Words are only valuable in so far as they express correct ideas. Now, the expression "*saccharine matter*," expresses an incorrect idea, and in this manner. It gives readers to understand that sugar devoid of saccharine matter exists in the abstract; an obvious absurdity. With equal propriety might we speak of salt devoid of saline matter. If by *saccharine matter* the public had been given to understand the principle of vegetable and animal sweetness generally, including not only sugar of the cane, but all other sugars, it would have been logical, and, therefore, useful; but as commonly employed it tends to nothing but embarrassment.

Sugar—even white or pure sugar—cannot be boiled for so much as one instant without the result of decomposing a certain portion of the same. The reader will therefore easily comprehend that in the course of the manufacturing colonial operation

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nature of which can be made clear to the reader in a few words. Water, although, as we have seen, it dissolves the coloured matters (up to a certain point) associated with sugar somewhat more readily than it dissolves pure sugar, nevertheless dissolves pure sugar also with dangerous rapidity. With alcohol, or mixtures of alcohol and water, the case is different. Every reader—provided he be not a total abstinence man—must have remarked that in making a glass of grog the sugar refuses to dissolve until water be added. The reason of this becomes obvious on reflection,—it not being the nature of sugar to dissolve in cold spirit. Starting from this fact, the idea is suggested of substituting spirit for water in the washing operation. It is a very expensive process, nevertheless one that is sometimes used. Not even spirit, however, is able to render muscovado sugar absolutely white, for the reason that certain of the coloured impurities associated with raw sugar are absolutely insoluble both in water and alcohol. This process of spirit washing has been more employed in the East Indies than elsewhere, but I believe it is gradually falling into desuetude.

The vacuum-chest, as it is called, has gained far more universal acceptance, and it would have been more usually employed but for the difficulty, under some circumstances, of complying with preliminary

conditions. In order that vacuum-chest suction, presently to be described, should be effective, it is absolutely necessary that the sugar to be operated upon should have been moderately crystallized. If it be small or soft in grain the process is wholly inapplicable.

To understand the theory and practice of vacuum suction, the reader may imagine to himself an iron box having a false lid of wire gauze above, and a means of connection with air-pump suction below. If ordinary moist sugar be spread upon the lid, and suction be applied by means of a pump, then evidently the tendency will be for all liquid matters to be drawn down and away by the force of atmospheric currents running through the mass. To a certain extent the process is effectual, provided the grain or crystal of the material operated upon be large, hard, and well formed; otherwise, not only liquid but sugar is drawn down, and the process becomes inoperative.

Within the last thirteen years attempts have been made, and successfully, to accomplish the removal of molasses from moist or muscovado sugar by centrifugal rotation. It is a far more efficient means of accomplishing the end desired than either claying, spirit washing, or the vacuum-chest; but, unfortunately, it necessitates abundant motive power, which in very many instances cannot be commanded

in the colonies, and which even here, in refineries at home, has been found totally incompatible with remuneration. The celebrated Bristol crushed lump, or Bristol crystals, as it is now called, is a product of manufacture accomplished by these rotatory machines. The rotatory system has, however, acquired its greatest development in the beet-root sugar factories of Belgium and France; indeed, so impure is the raw sugar of beet-root, that without this most efficient aid it is hardly possible to understand how the process of refining could be conducted.

A considerable amount of East Indian sugar is obtained as already announced, not from the cane at all, but from the juice of the date palm; a juice, indeed, equally rich in sugar as is the best cane-juice. The liquid is obtained by tapping, just as in this country we sometimes tap birch trees to obtain juice for making birch wine. When the date-juice is procured it is subjected by natives to an operation on the small scale not materially different to the scheme of operations pursued in the West Indies. Owing to imperfections of manufacture, however, the resulting raw sugar is so very black and impure, that it would be wholly unfit for European consumption. By the operation of claying some of the impurities can be removed, but all the fine specimens of East Indian, such as those of Dacca and Dobah, for example, are the

products of refinery operations not carried far enough to induce perfect whiteness. In point of fact, the highly crystallized East India sugars are mostly of the kind that is represented by the denomination "pieces," a term that will be still further explained when we come to treat of the home refining operations.

From this sketch it will be seen that what the sugar grower would wish to do if he could is this: he would wish to acquire a more efficient purifying agent than lime; thereby removing foreign matters at once and limiting the production of molasses. Now, the acetate of lead is an agent of this kind. Nobody, at all conversant with the properties of sugar and sugar impurities, doubts the efficacy of sub-acetate of lead, but, unfortunately, it is a poison. If the excess of this material could be removed easily, infallibly, and commercially, its use would be unobjectionable. Some years ago Dr. Scoffern took out a patent for a means of accomplishing this by a current of sulphurous acid. Thousands of tons of sugar have been manufactured by this process at home and abroad. No accident has ever arisen from its use; no accident ever can arise if the directions be complied with. Instead of merely getting out seven per cent. of the eighteen to twenty-three found in cane-juice as now accomplished in the West Indies, he has seen

in the colonies, and which [illegible] Spanish cane-juice. home, has been found to [illegible] his patent he sold a muneration. The celebration [illegible] the sale was con- or Bristol crystals, as [illegible] refiner, moreover, of manufacture accom[illegible] on his produce— chines. The rotatory [illegible]

its greatest develop[illegible] by the Government tories of Belgium [illegible] way:—Cognisant that is the raw sugar [illegible] been expended on this most efficient aid [illegible] sent a circular to the how the process [illegible] colony, and this without

A considerable [illegible] The circular bade them obtained as al[illegible] using a process that, how- at all, but fro[illegible] properly conducted, might be indeed, equally [illegible] used. Exactly the same line juice. The [illegible] used against steam-engines. in this co[illegible] patentee's royalties ceased. obtain ju[illegible] to the employment of his date-juice [illegible] it is, nevertheless, with this an operat[illegible] planters now put in the differen[illegible] trouble themselves to take out the W[illegible]

manufa[illegible] remarks, as will be observed, have so very [illegible] cane-juice as furnishing the unfit f[illegible] source; but, whatever the source, of [illegible] indications are presented to the but [illegible] these may be announced as follows: the[illegible] from any saccharine juice, as

much as possible, of all associated impurities; inasmuch as the presence of such not only retards crystallization, but is destructive to sugar.

This process of removal is usually termed defecation.

2. To co-operate the defecated juice at the lowest point compatible with existing circumstances, inasmuch as every degree of temperature above 140° F. is destructive of sugar.

In proportion as the saccharine juice is more impure, so is the process of defecation attended with difficulties. But root-juice may be accepted as typical of a saccharine-juice impure in the highest degree; cane-juice, as typical of the purest.

3. To promote crystallization and drain the saccharine crystals.

This is a statement of what has been usual hitherto; but many authorities of high standing are favourable to the scheme of doing away with the crystallization and drainage of colonial or raw sugar altogether. They advise that the saccharine juice should, either with or without defecation, be evaporated at once to the state of concrete, the latter to be imported in that state and committed to the home refiner, who, through the application of his improved resources, would be able to render it

to commerce in any form most available to the market. Conspicuous amongst the advocates of this treatment is Mr. Fryer. This gentleman having visited Antigua with the view of bringing his patent process for the manufacture of saccharine concrete into operation, delivered a lecture in the Court House of St. John's in the spring of the present year, where he stated that he had visited the island, not to propagate his views or to sound the praises of his own patent, but quietly to make arrangements for working it on a large scale on his own account. His firm, confident of success, were about to spend a large sum of money in the manufacture of concrete, but it was no part of his business, nor did he seek, to make anything like a crusade against the old system. So great had been the kindness shown to him personally on every hand, that he could not do less than respond to the invitation that he should address them this evening, and it would give him pleasure to afford to all at once the information which, amid the intense and varied occupation of his brief sojourn, he had been scarcely able to give to any in private.

The expression of the juice is of the highest importance. To have cane-juice—that is, sugar—in any quantity, in the megass used for fuel, is not much better than to mix wheaten flour in the wood we use to bake our bread. He had made careful

and repeated experiments with windmills having vertical rollers, and he found the average yield to be 49½ lbs. of juice to every 100 lbs. of canes. With a good steam-engine and 24-inch horizontal rollers he extracted 61 lbs. of juice from every 100 lbs. of canes, but on passing the megass a second time through the rollers, he obtained 9 lbs. more—70 lbs. upon the whole; and this he thought would be obtained at one operation from a well-constructed modern mill. The loss in the use of the windmill appears to arise in part from the intermittent high speed not giving the time necessary for the exudation of the juice from the closely-packed cells of the canes. He looked forward to the time when, by great pressure and slow speed, 80 lbs. of juice would be extracted from every 100 lbs. of canes. He had indeed in one experiment, conducted on a small scale, succeeded in extracting at the rate of 84·85, that is, 84 lbs. 13½ oz. of juice from 100 lbs. of canes, and in this case the resulting megass was so dry as to be capable of ready ignition without further drying.

To revert to the cane-juice—this was found to darken rapidly in colour on exposure to the air, and though for several hours no material injury appeared to be done to the cane-sugar or *sucrose* present, the increase of colour was not entirely removed by subsequent defecation; and the amount

of acidity went on steadily increasing. In one case—a pattern of too many others—where the juice, after expression, flowed down a spout 250 feet in length, from the mill to the boiling-house, occupying in its descent about half a minute, the amount of acidity increased to 253, and the colour deepened fourfold. This mischief, due to oxydation, pointed to an advantage likely to be gained by steaming the canes before grinding. This plan, however, though satisfying most of the conditions of the problem, labours under the fatal disadvantage that the canes lose weight in the process in consequence of the heat causing the exudation of a considerable amount of juice, which cannot be advantageously recorded. No less than 4·6, somewhat more than 4 lbs. 9½ oz., proved, after repeated experiments, to be the average loss upon every 100 lbs. of canes.

Respecting boiling, all heat above 140° is capable of exerting an injurious effect. As regards the time, this effect is proportionate to the duration of the heat; the continuance of any syrup for two hours at any given temperature would do just double the mischief which would be done by its continuance at the same temperature for an hour. But as regards the heat, the mischief increases about as the square of the difference from 140°, the highest innocuous temperature. So at 100°, during any given time,

a certain degree of mischief would be done. To keep the same syrup for the same time at the heat of 180 would give four times the mischief, at 200° nine times, the difference of 180° from 140° being twice as great as that of 160°, and that of 200° being three times as great.

And this mischief consists partly in the change of colour, partly in the change of a quantity of cane-sugar or sucrose into fructose. This is made still greater by the fact that every particle of fructose in a mixed solution detains from crystallization near its own weight of pure sugar. It would be impossible, after mixing equal weights in solution of loaf sugar and fructose, to recover the former in a crystalline state.

The changes produced by the atmosphere alone, without the action of heat, show the necessity of proceeding instantly to raise the temperature to the boiling point, and the concentration should be continued without loss of time. The temperature should not, however, be raised beyond the lowest effectual heat. He gave many results arrived at by the folarising saccharometer, showing the gradual and rapidly-increasing change of cane-sugar into fructose, from the simmerer through the coppers in succession to the tache—the extreme limits of the change being in one case seventeen per cent. of the sugar present. Remembering what was said

above of the entangling action of fructose, this would represent an ultimate loss upon the production of thirty-four per cent.!!

It is to obviate this that the patent concretor has been contrived. The apparatus is not liable either to fracture or derangement, and no part involves any peculiar niceties of construction. It is very economical in fuel and in attendance. When in full action, the cane-juice flows in continuously at one end, and at the other it is as steadily removed in the shape of concrete. The whole period of the passage of any particular quantity from end to end does not occupy more than fifteen minutes, and during that interval not one grain of cane-sugar is changed into fructose.

Mr. Fryer here showed as a sample a lump of the concrete of considerable size. Its colour was a pale greenish yellow. In consistency it is almost as hard as a stone, and it may be cast as it leaves the concretor into blocks of any size. In taste it nearly resembles sugar-cane, having no burnt flavour. It yields on re-dissolution a liquid so precisely similar to cane-juice, that the most close and careful scrutiny can hardly discriminate between the two liquids. It may be packed for carriage in bags; it shows no tendency to deliquesce, and, of course, cannot drain. Its colour is so good as to be certainly preferred by the refiner to good mus-

covado sugar, and its make does away with hogsheads, molasses, rum, puncheons, and curing houses, while the increase in value and the saving of drainage appear to equal more than 4*l.* sterling per hogshead.

The concretor, the cost of which will be probably about 1,000*l.*, does its work at the rate of not less than 10 cwt. per hour. Its construction is entrusted by the patentee to Messrs. Manlove, Alliott, and Co., engineers, Nottingham.

CHAPTER V.

Growth and Manufacture of Date, Beet-Root, and Maple Sugars.

The extraction of sugar from juice of the date, the crude result being the variety of raw sugar denominated khaur.

Relative to this branch of the subject, the following description appeared in *The Grocer*, in 1862. It may be relied on as authentic:—

"The genus to which the date palm belongs, comprises nine known species, of which six are indigenous in India, and are distinguished as: 1, *Phœnix acaulis*; 2, *P. Ouseleyana*; 3, *P. pedunculata*; 4, *P. farinifera*; 5, *P. sylvestris* or *dactylifera*; 6, *P. paludosa*. The sugar-yielding variety, *Phœnix sylvestris*, is known as the wild date of Bengal: *Phœnix dactylifera* is the name given to the true date palm of Arabia and Africa; but as it appears to be undistinguishable from the Beng[illegible] variety, except in size and vigour of growth [illegible] ems little doubt that any apparent differen[illegible] nly

to superior cultivation and variety of climate or soil; and it being always a cultivated tree in Bengal, the specific name "*sylvestris*" may have been originally given, owing to its inferiority in size to the African or Arabian tree, with which European botanists were more early familiar.

"The date palm, when not stunted in its growth by extraction of its juice for sugar, is a very handsome tree, rising in Bengal from thirty to forty feet in height, with a dense crown of leaves spreading in a hemispherical form from its summit. These leaves are from ten to fifteen feet long, and composed of numerous leaflets or pinnules, about eighteen inches long. The trunk is rough, from the adherence of the bases of the falling leaves, which serves to distinguish it at a glance from the smooth-trunked cocoa-nut palm, which in its leaves only it resembles. Like all of the *Phœnix* genus, the trees are diæcious, and the fruit hangs in dense bunches from the centre of the crown of the female tree: it flowers about April or May, and the fruit ripens in July or August; the latter is, however, of a very inferior description in Bengal, and is seldom gathered except for its seed, from which the young trees are raised. The fruit, indeed, consists more of seed than of pulp, and altogether is only about one-fourth the size of the Arabian kind brought annually to Calcutta for sale, and,

when fresh imported, a rich and favourite fruit there. This inferiority of the Bengal fruit may no doubt be attributed to the entire neglect of its improvement there from time immemorial, and perhaps, in some measure, to the practice of tapping the trees for their sap, so universally followed in the districts around Calcutta, its principal range of growth.

"The date tree is met with in almost every part of Bengal Proper, but it flourishes most congenially, and is found plentifully only in the alluvial soils which cover its south-eastern portion, excepting only such tracts as suffer entire submersion annually from the overflow of their rivers, as is common in portions of the Dacca, Mymunsing, and Sunderbund districts. The extent of country best suited for its growth, and over which it is found most plentifully as above indicated, may therefore be taken as within an area stretching east and west about 200 miles, and north and south about 100 miles, and comprehending by a rough estimate about 9,000 square miles—within an irregular triangular space.

"The practice of extracting its juice, however, for the production of sugar, extends at present over a much smaller area, probably not more than two-thirds of the above described space; and if we consider further, how small a portion of the

favourite date districts even are as yet occupied by date tree cultivation, the room for its future extension, even if confined to these tracts alone, appears a wide one indeed. If we trace an irregular parallelogram, stretching eastward from Kishengunge, in the Nuddea district, to Backergunge, and from Mahduppore, in Furreedpore district southward to the borders of the Sunderbunds, we shall find a space of about 100 miles long by 80 broad, and comprehending the district of Jessore, with portions of Furreedpore, Nuddea, and Burrisaul, to which the product of date sugar is mainly confined, although the goor—or the first raw produce made by boiling down the juice—is found commonly manufactured for native consumption on the spot, in many localities situated beyond these assumed limits.

"Throughout the present Date tract, the quantity and quality of the sugar produced vary considerably. The high and dry lands of parts of Kishnaghur and Pubna yield a strong well-crystallised product, though less in quantity than from trees of the Jessore and Sunderbund soils; in which, with a more rapid growth of the tree, a greater flow of sap, and a less rich, though still good and grainy sugar is produced. The cultivation in these districts is accompanied by a great advantage, in the cheap and abundant supply of fuel for boiling the juice and

refining the sugar; and there is probably no part of Bengal where the cultivation may be extended, with more profit than in the more elevated lands of the Sunderbund grants.

"The young plants are raised from seed sown during the rains, and are ready for planting out in the following April or May, after the first showers of the season have moistened the ground sufficiently. Before the date sugars became important as a staple for export, and the cultivation extended, the trees were seldom seen planted elsewhere than along the hedge-rows or boundaries of the fields, or on other spots where they did not interfere with the growth of cereals or other field crops. Gradually, as date produce became more valuable, systematic plantations appeared, and fields were set with trees ten and fifteen feet apart, but without much regard to order or regularity of distance. After planting, no manuring or further expense was incurred, except, perhaps, in supplying fresh plants in place of those destroyed by cattle.

"The spaces between the trees are generally occupied by oil-seed or other dry weather crops, and thus the cost of a native plantation is reduced, whilst the trees benefit by the ploughing, which loosens the earth, and the ground is kept free from weeds.

"At the expiry of the fifth year from the

of the young tree in the field, it is ready to be tapped for its juice. This is the average time allowed, though it may be varied a year sooner or later by the difference of soil and climate. The first year a young tree is tapped, it is reckoned to yield only half the usual quantity of juice produced by a full-grown tree; for the second year of tapping it is reckoned to yield three-fourths of full average quantity; and it is not till the third year of bearing that it is considered as in full yield.

"The process of tapping and extracting the juice commences about November 1. Some days previously the lower leaves of the crown are stripped off all round, and a few extra leaves from the side of the tree intended to be tapped. On the part thus denuded a triangular incision is made with a knife about an inch deep, so as to penetrate through the cortex, and divide the sap vessels; each side of the triangle measuring about six inches, with one point downwards, in which is inserted a piece of grooved bamboo, along which the sap trickles, and from thence drips into an earthen pot, suspended underneath it by a string. The pots are suspended in the evening, and removed very early the following morning, ere the sun has sufficient power to warm the juice, which would cause it immediately to ferment, and destroy its quality of crystallising into sugar.

"A plantation is always divided by the cultivator into seven equal sections, and one such section is cut afresh daily. The cutting is made in the afternoon, and the pot suspended as above mentioned. Next morning the pot is found to contain, from a full-grown tree, ten seers of juice; the second morning four seers; and the third morning two seers of juice; the quantity exuding afterwards is so small, that no pot is suspended for the next four days. On the evening of the seventh day it again comes to the turn of this section of trees to be cut, which is effected by a thin slice being pared from the triangular face, which, by again dividing the sap vessels, causes the juice to flow afresh as at first. Each section is thus cut in succession, and the process is repeated throughout the goor season, which usually terminates about February 15, after which the heat of the weather causes the juice to ferment so rapidly, that it is no more convertible into sugar, and consequently not worth the labour of extraction and evaporation of its water, as molasses only would be the product. Juice produced during the daytime of the cold season is of similar quality, and for the same reason is allowed to run to waste.

"Daily at sunrise, throughout the goor season, the industrious ryot may be seen climbing his trees, and collecting at a convenient spot beneath them the earthen pots containing the juice yielded during

past night. Under a rude shed, covered with the leaves of the date tree itself, and erected under the shade of the plantation, is prepared the boiling apparatus to serve for the goor season. It consists of a hole of about three feet in diameter sunk about two feet in the ground, over which are supported by mud arches four thin earthen pans, of a semi-globular shape, and eighteen inches in diameter; the hole itself is the furnace, and has two apertures on opposite sides for feeding in the fuel, and for escape of the smoke. The fire is lit as soon as the juice is collected, and poured into the four pans, which are kept constantly supplied with fresh juice as the water evaporates, until the whole produce of the morning is boiled down to the required density. As the contents of each pan become sufficiently boiled, they are ladled out into other earthen pots or jars, of various sizes, from five to twenty seers of contents, according to local custom, and in these the boiled extract cools, crystallizes into a hard compound of granulated sugar and molasses, and is brought to market for sale as *goor*.

"The subsequent processes by which the goor is deprived more or less of its molasses and impurities, and the drier and more merchantable kinds of sugar are prepared for market, will now be briefly described. These processes are always conducted by a distinct class of operators, who purchase the

goor from the cultivators, and bring it to various stages of purity and dryness under different denominations.

" 1st. Khaur is made by filling the goor into coarse sacks or gunny bags, and pressing them between bamboos lashed together, or between heavy weights, until thirty or forty per cent. of the entire weight is forced out in the shape of molasses. The residue is then mixed, packed in clean bags, and is ready for sale.

" 2nd. Fine Khaur or Nimphool is made by repeating the above process for making khaur; the only difference being that the khaur is sprinkled and mixed with water before subjecting it to the second packing and pressure. This causes a further portion of the molasses to be washed and separated from the mass, and the product is lighter coloured and finer than the khaur, and about fifty per cent. only of the original weight of goor remains. A third application of the same process is sometimes resorted to, which carries away another five per cent. of the original weight, and leaves a residue still drier and lighter coloured than the ordinary nimphool.

" In all nimphool and khaur sugars, however, a certain portion of water or moisture remains, it being never subjected to any sun-drying or other process for evaporating the water, and this renders

it liable to deliquesce and sweating through the bags in which it is usually packed. This is specially the case in damp weather, and loss of colour and acidity follow in a few weeks.

"3rd. Dullooah, or Doloo, is made by filling the ghoor into round baskets, or conical earthen vessels, holding two or three maunds each. The baskets being of an open fabric, and the cones made with a hole at the apex, the molasses drains from the goor into a vessel placed beneath, the process being encouraged by a stratum of three or four inches thick of a wet grass or aquatic weed called 'seala,' placed on the surface of the goor. The moisture from this attenuates the molasses in the goor, and assists the draining. As soon as the weed is dry it is removed, and the upper stratum of goor, now deprived of its molasses, is scraped off with a knife to the depth of two or three inches, and a fresh top of 'seala' or wet weed is applied. When dry, a further portion of sugar is cut off as before, and this is repeated until the basket or cone is emptied. The sugar, as scraped off, is exposed in the sun on mats to dry, and is then mixed and packed for sale; and is, when well made, a dry, light, sand-coloured dullooah. Thirty to forty per cent. of produce, varying with the quality of the goor, is made in this way from a given quantity of the [illegible]. The resulting molasses having by the

operation of the weed a small portion of the sugar-crystal melted with it, is subjected to a boiling to evaporate the water, and an inferior, weak-grained and dark-coloured goor is the result. This is again subjected to the weed-draining as before, and a further portion of ten to fifteen per cent. weight of the original goor is obtained. Dullooahs, if well dried before being packed, may be kept without deteriorating for several months if the weather be dry; but they always imbibe moisture, and sustain consequent injury from the damp air of the rainy season in Bengal.

"Pucka Cheenee, or Gurpatta, is the native refined sugar, made by subjecting khaur to a process somewhat resembling that of the English refiner. The khaur is melted in water to the consistency of thin syrup, which is then placed over a fire in an earthen pan, and brought to boiling point, the defecation being assisted by potash temper and sprinkling in of cold water. After skimming, it is filtered through a cotton cloth, and the clarified syrup is then boiled briskly until the water is evaporated to such a degree as to allow the sugar to form a hard crystal as it cools. It is then poured into an earthen cone, and, when cold, the plug is withdrawn, and the syrup allowed to drain from it, assisted, as in the dullooah process, by the application of the damp weed or seala. As it becomes whitened by

the latter, it is scraped off, sun-dried, and packed for sale. The syrup, as it collects from the cones, is boiled up with fresh goor, and produces, by the same process, an inferior or second quality of gurpatta, and the syrups of the latter are once more boiled alone, and produce a still inferior weak and reddish sugar called by the manufacturers "jerunnee," which is literally "lasts." Gurpatta, if well made, and pure from mixture with other kinds, is of a bright and clean aspect, fine and dry; and, if protected from the weather, will keep without injury throughout the rainy season. The ordinary yield of gurpatta from good goor is reckoned as follows: three maunds of good goor yield of—

	Mds.	Srs.
First or white Gurpatta - - -	0	20
Inferior or mixed ditto - - -	0	10
Syrups or Jerunnee - - - -	0	10
Molasses - - - - - - - -	1	28
Loss - - - - - - - - -	0	12
Total, Mds. - -	3	0

"5th. Dobarah is a quality superior to gurpatta, being a good white, dry, and well crystallised sugar. The process is similar to that of the gurpatta; but the material used being dullooa instead of khaur, a purer sugar is obtained, which much resembles the crushed refined sugar of the European refiner."

Origin and Process of Manufacturing Beet-root Sugar.

BEET-ROOT SUGAR, though a very important and increasing article of commerce on the Continent, occupies in England an insignificant position.

In 1747, Margraff, the eminent German chemist, discovered that sugar existed in the roots of many plants; those experimented upon by him were Skirret (a variety of parsnip), the white beet and the red. He found that when slices of these were dried by a very gentle heat, small spicular crystals of sugar were observable by a microscope. He next reduced the dried root to a powder, and digested it in boiling alcohol, by which the whole of the sugar was dissolved, and the mucilage, starch, and most of the other impurities were left behind. By these experiments he discovered that white beet lost by drying three-fourths of its weight, and the red beet seven-eighths.

It continued to be regarded as an article of curiosity, and was sold at fancy prices; its sweetening power and identity with cane sugar were doubted —the former prejudice still existing in England. Half a century elapsed before any attempt was made to manufacture beet-root sugar commercially. However, in 1788, a factory was erected and

worked at Cumoon, in Silesia, by M. Achard, of Berlin, at the request of the Prussian Government. He followed the plan of the inventor, with one exception, viz., he boiled the root previous to pressing it; the result was utter failure; for by so doing he rendered soluble most of the starch, and introduced an additional embarrassment in the subsequent operations. The first energetic impulse that was given to the manufacture of beet-root sugar was by Napoleon I., when he endeavoured to ruin the colonial trade of Great Britain by establishing the continental blockade. This caused an advance in the price of foreign sugar to 8 or 10 francs the kilogramme; to obviate the pernicious effects of this false step, he offered premiums for the best method of extracting sugar from beet-root, and erected an imperial factory at Rambouillet. The premiums offered by the Emperor induced the chemists and scientific men of France to exert their skill; of whom were M. Chaptal, Crespel-Délisse, Benjamin Delessert, Barruel, Isnard, and others. M. Chaptal, at that time Minister of the Interior, and a manufacturing chemist of considerable eminence, had his attention drawn to the attempts made in Prussia and Germany to manufacture sugar from beet-root. The result of his observations was success. The es-

tablishment of a manufactory at Amboise, on the Loire followed, and the first sample there made being conveyed to the Emperor Napoleon, he was so delighted that he ordered it to be placed under a glass case, as a specimen of the achievements of France. Soon after this, numbers of factories commenced working; the result being that sugar made by this process sold at less than a foreign article. On the cessation of the continental blockade the system became unremunerative. In the year 1825, in the north of France alone, there were twenty-six establishments founded for the preparation of beet sugar, and from that period to the present the number has gradually increased, and the quality has also been much improved.

Process of Manufacture.—The roots having been washed and rasped, the raspings are submitted to hydrostatic pressure, whereby nearly all the fluid is squeezed out. Beet juice, when freshly expressed, is almost colourless, but it is thick and clammy to the touch; its taste and smell are both offensive. Far more nitrogenous materials enter into the composition of it than of cane juice, as is evidenced by the copious evolution of ammonia, if allowed to decompose.

The juice being obtained, the manufacturer's first object is to defecate it, or in other words, to reduce

it as closely as he can to the condition of a mere solution of sugar in water. He effects this by tempering with lime, as is done with cane juice; only the impurities here being more diversified in quality, and much more considerable in quantity, the defecation has to be more accurately conducted.

The action of lime and heat combined having brought many impurities to the soluble from the insoluble condition, they have to be removed. This is partly accomplished by skimming, and partly by filtration. Bag filters are sometimes used at this stage, but more usually the manufacturer avails himself of the mechanical agency of his spent charcoal. The result of this operation is to effect a mechanical separation only, spent charcoal being endowed with no decolorising power.

Operations up to this point are the same in all beet-root sugar factories, but onwards to the end they are differently prosecuted. Whatever the scheme of future operations may be, one set of general operations has to be regarded. The first thing to be done is to bring the partially defecated juice to a higher degree of concentration. In Belgium this is effected, in some of the best ordered sugar refineries, by the agency of an instrument called the *Cone de Lembecq*, which consists of a double copper chimney, the inner and outer wall of

which are separated by the interval of a few inches, thus forming a space into which steam is admitted, whereby the chimney becomes a copper jacketed tube of the same metal. Arrangements being as described, and such a chimney set up vertically, it is evident that if a fluid be allowed to trickle down it, whether internally or externally, evaporation will take place. In consequence of the trickling going on both inside and outside, the evaporation is very rapid.

If weak saccharine juice be made to run down as described, and then received in some appropriate vessel, it will be found in a sufficient state of concentration to favour the chemical action of charcoal, which is used packed in tanks, just as in ordinary refineries. The liquor having come through the charcoal may be at once transferred to the vacuum pan, but in some of the continental beet-root factories another system of concentration is adopted, to be next described as—

"*Tank Evaporation.*"—The concentrated and purified juice being set aside in shallow tanks along the floor of a chamber heated from 120° F. to 140° F., evaporation goes on, and crystals of good quality are deposited. These from time to time being baled out by a perforated copper ladle, are transferred to turbines or rotatory machines, similar to

those used for making Bristol crystals. The yet uncrystallised fluid, or molasses as it may be called, is whirled away, and crystals, more or less pure, remain. These crystals are now put into an ordinary refinery, jacketed, beaten, and kept at the crystallising temperature, in contact with a certain quantity of strong and pure syrup. The result of this treatment is a mixture of crystals with syrup, in a fitting condition to be filled into moulds.

This stage arrived at, future operations may be conducted exactly as in ordinary refineries, but in several French and Belgian factories the coned loaves are arranged in an enormous turbine, a machine like a water-wheel, fixed vertically, and this turbine being set in motion they are drained, liquored, and dried, with great rapidity. This operation, though expeditious and very effective, is attended with danger. On one occasion a turbine flew to pieces in a factory at Valenciennes; when, besides demolishing the walls of the building in which it had been erected, thirteen men were killed.

Here it may be proper to state, that beet-root sugar is not only identical in every respect with cane sugar, but that much of the Dutch lump sugar is actually the produce of beet-root. The circumstance cannot be too much insisted upon that the seeming distinction between yellow beet sugar and

yellow cane sugar, depends on the extraneous coloured matters present. These, when eliminated by refining, leave white materials in all respects identical. There is positively no difference between these two, whether of colour or of grain. Grain or crystals can, from either, be developed to the size of the largest candy, if desired; in fact, at the present moment France is sending here large white crystals produced from beet-root to compete with London, Bristol, and Scotch, and other crystal manufactories.

Maple Sugar.

In some of the Northern States of North America, also in Canada, the "*Acer Saccharinum*," or sugar maple, constitutes an important source of sugar extraction. The juice of this tree is rich in saccharine contents, the sugar it furnishes being precisely that of the cane; and from which, when refined, it cannot be distinguished, but prior to the process of refining, its peculiar taste renders it easy of discrimination from cane Muscovado. Here, however, as in other similar cases, it is the associated coloured impurities which impart a specialty to the material. It is impossible that the maple tree should ever enter into close competition with the cane, because of the unadaptability of its

growth to combined operations. In this respect it is assimilated to the sugar-yielding palms of India: moreover, the general process of procedure is nearly the same. In some respects maple trees have an advantage over date trees, notably that of their growing in a cold climate. Date juice so soon as it flows from the parent stem, must be manipulated at once; otherwise, it ferments and spoils; but maple juice may be allowed without injury to lie by for four and twenty hours, or even more.

Practically, it is found that maple trees which spring in forests are not so sugar-yielding as others which grow in small clumps, free from underwood. The sugar season commences in March, and lasts about six weeks, during which time operations are carried on in temporary buildings, conveniently erected. A clump of maple trees having been fixed upon by an explorer, he establishes a "sugarie" in the immediate neighbourhood, by which term is meant the collection of huts and apparatus used in the process of extraction. Compared with the appliances of sugar cane abstraction, those used in producing maple sugar are very inexpensive. The operator begins by tapping the trees with a three-quarter inch augur, and in doing this care must be taken that the perforator is not driven too deep. Practice has established the rule that a hole

nearly two inches in depth is best. More juice may indeed be drawn from a tap driven deeper, but the general saccharine contents are not more than a shallow perforation yields, and this being so, of course there is an increase of expense, because of the need of more fuel used in evaporation. One attendant can usually manage two hundred and fifty trees, his work then not being heavy, if the plantation lies compactly together. When a sufficiency of juice has been collected, it is evaporated in kettles, each holding from fifteen to twenty gallons. The operation, scientifically regarded, leaves much to be desired. The object, of course, should be to promote the separation of extraneous matter by proper defecating processes, rather than to encourage the promotion of crystals, but the maple-sugar maker proceeds in the imperfect way of his forefathers. A partial defecation is effected by beating with milk or white of egg—sometimes both—and skimming, then the juice is boiled down to a thicker consistency than is proper for drainage, the result being a mass of what cane-sugar refiners call "syrup-bound crystals." Maple syrup is agreeable to the taste, though perhaps not so agreeable as cane syrup; the sugar is, as I have before remarked, absolutely identical with that of the cane.

CHAPTER VI.

MANUFACTURE OF REFINED SUGAR IN ENGLAND.

NOT only did Venice for some centuries transport sugar for the Western World, but having transported it, she refined it. The art of sugar refining was, indeed, discovered by the Venetians, whence originated the term "*pains de Venise*,"—*i. e.* Venetian loaves, meaning loaves of sugar.

In the British Isles the raw staple of refining is raw sugar extracted from the cane. On the Continent, however, raw beet-root sugar is also employed.

Assuming that sugar extracted from cane juice is the staple to be operated upon, the first care of the refiner is to choose the sorts that suit him best. Fortunately, the varieties of Colonial sugar that the grocer most approves are not generally the best adapted to refining. The grocer likes raw sugars

having a rich yellow or straw-coloured tint, whereas the refiner aims at procuring those which are grey. The quantity of associated impurity may be the same in either case; but the grey colouring matters are the more easily removable by refining processes.

A well-ordered refinery should be a tall building of many stories, and the apparatus should be so arranged that pumping or lifting the sugar solution should be as much as possible dispensed with. This involves a competent fall, whereby the first operation having been commenced on the highest floor, the last may be conducted on the ground floor. Raw sugar of the proper quality being procured, it is thrown in a heap like so much manure on the floor of the top story. Close to this heap is what the chemist might call the "solution vessel," but what in refineries is always called the "blow-up cistern," and the construction of which must be now described. It is a rectangular iron or copper vessel, capable of holding 1000 gallons, or more, and into which a pipe communicating with the steam engine boiler dips. From this pipe so soon as a cock is turned, a jet of steam escapes, and if this steam be caused to pass through cold water, the latter is very rapidly brought to boiling temperature. A number of men stand round about the sugar heap, each man having a shovel. Then,

like so many navvies clearing away earth, the workmen begin to turn the sugar into the blow-up pan; water being let on in the mean time, and the steam-cock turned full. If the sugar be very pure and good, nothing is added to it in the blow-up cistern; but far more generally, some bullocks' blood is stirred up along with it. In hot weather this material is most offensive, and, generally speaking, it may be said that this particular operation of blowing-up is one of the most offensive to be encountered in the whole circle of industrial art. As regards the propriety and expressiveness of the term "blowing-up," no one who had been once a witness of it would demur to the designation. Hot steam coming into mixture with cold water, a noisy commotion is established not dissimilar to the bellowing of angry bulls. A person unacquainted with the practice of sugar refining might reasonably infer that the sugar constituting any one charge of the blow-up pan is weighed. Such an inference would be wholly wrong. Not only would the operation of weighing be tedious, but it would be also unnecessary. The operator goes on adding from time to time more sugar and more water, until the proper density or thickness has been arrived at, which he knows by using a Baumé's hydrometer.

The process of blowing-up causes much scum to rise to the surface, more particularly if bullocks' blood—called by the refiner "spice,"—have been used. Some of the grosser impurities are skimmed bodily off, and cast aside, but by far the chief amount has to be separated by a very ingenious process of filtration. Several sorts of filters have been used for this purpose from time to time, but the "bag filter," as it is called, having almost superseded all others, I will devote exclusive attention to this very ingenious system. The bag filter in itself may be compared to an ordinary pillow-case, only about three times the length. The mere bag, however, cannot efficiently be used for accomplishing filtration: the whole apparatus involving three parts, viz., the bag proper, the bell, and the sheath. To acquire a just idea of the sheath, imagine a tube of coarse canvas, or rather a rough hempen net, somewhat longer than the filter bag proper, open at both ends, and when expanded forming a tube about five inches in diameter. Through this sheath the entire length of a filter bag is pulled, with the exception of a length sufficient to give attachment to the bell or nozzle. This latter is usually made of brass, but sometimes of iron. It is a truncated conoidal tube, about five inches long, having a diameter of about two

and a half inches at the larger extremity, and tapering to about one inch and a half at the smaller. At the larger end, moreover, there is an outer rim, so that upon the whole the contour of a bell is not very widely departed from. When the circumstance is further mentioned that an external screw thread is turned on the smaller end of the bell, we shall have achieved its full description. Now, it obviously follows that if the mouth of a filter bag be tied over the larger or ribbed extremity of a filter bell, the bag cannot slip off. It follows, moreover, that by means of the smaller, or screw extremity, we may readily attach such a bell nozzle to a plate perforated with a suitable hole in which a screw thread has been turned. For any one particular filter the description is complete, but in practice several—often many scores—are screwed very close together into one perforated plate, the latter forming the upper part of a steam chest. The object of this very ingenious arrangement is to acquire a very large filtering surface in a very small space; and, the result is all that could be desired.

The filter bags are screwed by their bell nozzles into the upper surface of the steam chest, as already described; and the steam chest is so placed in the refinery, that whilst the upper surface stands on a

level with the floor of the upper story, the chest itself rests on props that raise it above the floor of the second story; moreover, the upper surface of the filter chest is converted into a shallow tank by a high rim riveted to its edges.

Preceding arrangements being contemplated, it will be immediately seen that on turning a tap attached to the blow-up tank, the whole of the solution contained in the latter may be made to pass in a stream into the shallow tank, and thence through the filter bags. Inasmuch, too, as the blow-up vessel is supplied with a false perforated bottom, the latter strains away many of the grosser impurities. The liquid at length passes through the filter bags, and thence is turned upon enormous beds of grained animal charcoal, the operation of which will be hereafter described. Great care is taken by the filter man that liquor do not pass on to the charcoal until it is bright: hence the first portions are either caught in a bucket or allowed to pass into a spare tank. The degree of brightness is ascertained by collecting a portion of the liquid in a glass, and holding it between a flame and the eye. As regards the colour of the liquid as it comes from the bag filter, it may be compared to the tint of old port wine.

After the lapse of some hours the liquor begins

to percolate through the animal charcoal. The effect of this substance is wonderful—almost magical. When a charcoal filter is in thoroughly good condition, so completely does it effect the decolorization of the liquor, that the latter is quite as colourless as the purest water, and infinitely more brilliant: in point of fact, the play of light seen on looking through it is only comparable to the diamond for lustre. Gradually, however, the charcoal begins to lose its efficiency. The liquor it yields grows deeper and deeper in colour, but the process may nevertheless proceed until the tint of the filtered liquor resembles that of brown sherry.

The whole of the liquor having gone through at last, the operation of boiling may commence. Formerly open vessels heated by naked fires were employed in refineries. Inasmuch, however, as that plan has been totally abandoned, and the process of vacuum-pan boiling adopted, I shall devote attention to the latter exclusively.

If the reader of this should ever have travelled in high mountainous regions, he will have discovered that he could neither supply himself with a good cup of tea nor well boiled potatoes. The explanation is simple, and upon a full comprehension of the state of the case, hinges the whole philosophy

of the vacuum-pan. To boil potatoes satisfactorily, and to make a satisfactory cup of tea, the water must have at the boiling point a temperature not less than 212° of Fahrenheit's thermometer. This is the temperature at which water boils at the level of the sea, because at this level the atmosphere presses with such a force, *i.e.*, about 14 pounds to the square inch, that the particles of water cannot burst into steam rapidly—cannot boil, that is to say, until the degree of 212° F. be acquired. But as we ascend upwards, necessarily a portion of the atmospheric presure is removed; hence the boiling point of any given liquid is lowered. Now, as I have already shown, heat is most destructive to sugar, hence the desirableness of boiling away the liquid which holds it in solution at a lower degree of heat than would be necessary under ordinary atmospheric pressure. The vacuum-pan enables the refiner to accomplish this; and, moreover, it vastly expedites the whole operation.

The vacuum-pan consists of two copper pans joined edge to edge in such a manner that, but for certain attachments, presently to be described, it would be a closed vessel; and which can at any time be made a closed vessel by the turning of certain taps. There is no fire in contact with the vacuum-pan, nevertheless it is destined to boil sugar liquor.

How is the heating accomplished? Simply thus:—Surrounding all the lower part of the vacuum-pan is a steam jacket, and winding round the same lower part internally is a copper steam coil; hence the means of applying heat are ample. Lastly, as to the vacuum, this is effected by means of an air-pump.

Boiling being determined on, the operator begins by making all openings secure and setting the air-pump in motion. He next turns a tap in communication with the liquor tank, and the air-pump still acting, liquor is sucked—to use a popular expression—into the vacuum-pan. Being there, it rapidly acquires heat, and boils; the process being made visible by what is called the "sight-hole," which is a circular pane of very thick glass. By taking observations through this sight-hole, the boiler can acquire knowledge as to the progress of his boil. Moreover, in connection with the sugar-charge, there are a barometer and a thermometer, both of which give useful indications.

Nevertheless, as the boiling draws towards conclusion, the operator requires more information than barometer, thermometer, and sight-hole collectively are able to supply. He requires actually to withdraw a portion of the contents of the pan for near examination. Here, then, arises a very curious

problem: viz., to remove something out of a vessel exhausted as near as possible to the condition of a vacuum without letting in atmospheric air and destroying the vacuum. It would be difficult to convey to the reader an adequate notion of the beautiful means by which this is accomplished. Suffice it to remark, that a brass rod ending in a sort of spoon is thrust, with certain necessary twists and wriggles, through a sheath, and withdrawn under the manipulation of other twists and wriggles. If the essential movements be not accurately accomplished, air rushes in, and some hundreds of pounds' worth of sugar are jeopardised, if not ruined outright. The sugar boiler keeps the precise nature and sequence of these motions a profound secret, to be sold at an exorbitant price; nevertheless the reader, if he be a small swordsman, and will attend to the following directions, shall learn them for nothing. Taking the proofstick (for by this name the brass rod is called) in the right hand, look for a small round hole near the handle, and turn that hole downwards. Now thrust *tierce* quite down to the bottom of the sheath. Next bend the wrist upward to *carte*. Return to *tierce*, and withdrawing about six inches, suddenly change to *carte* again, and withdraw through the whole length of the sheath. Herein lies the whole secret.

It would be next to impossible to acquaint the reader with the indications of the liquor having been boiled enough. But assuming it to have been boiled enough, the operator then quickly turns off the steam, shuts off the water from the condenser, breaks the air-pump connection, and opening a large lever valve in the lower segment of the pan causes the whole charge to fall to the next or lowest floor, where it is received in a vessel called the "heater" (sometimes called, oddly enough, the *cooler*), that vessel being comparable to the lower segment of the vacuum-pan *without* its coils but *with* its steam-jacket. In this heater the charge is allowed to remain until the crystals have become large enough and hard enough to please the operator. The next process consists in filling the prepared charge into sugar-moulds—copper, iron, or earthenware cones—shaped each like a sugar-loaf. In the apex of each of these cones is a small hole stopped with a pledget of paper. Removed to these cones the crystallized matter sets; and after a proper delay, when the crystalline matter has aggregated together and set the non-crystallizable matter loose, the paper pledget of each mould is removed, and each mould set upon a corresponding pot to drain. When all the moisture has drained away, the reader will expect to find a loaf of dry white

sugar. By no means. Notwithstanding all the care taken, the sugar is coloured, and the colouring-matter has to be washed away. This is accomplished by the two processes of *claying* and liquoring. Actual clay was formerly used, exactly as in Cuba; but what the refiner now calls "clay," is only a sort of mortar of sugar and water. A layer of this mortar being laid on, a portion of the coloured impurities is washed away; but to effect the final clearage, a liquor of water saturated with sugar so that it can dissolve no more, is poured upon the clay. This sinking through the loaves, all coloured impurities are bodily washed into the pot. It remains now to drain and dry the cones of sugar, termed lumps, titlers, or loaves, according as they are large, medium, or small. The tops of lumps and titlers are usually broken or cut off, but the tops of loaves are nicely turned by what is called a "*nosing machine.*" The cones of sugar are next papered and stoved, and the operation is complete.

But the syrups that drip into the pot are not thrown away. They are rich in sugar, and must be economised. They go to form an inferior sugar: *their* drippings, boiled, drained, and cleared become pieces; the droppings of pieces, similarly treated, are bastards; and the drippings of bastards are treacle.

What I have endeavoured to elucidate in this chapter will convey a tolerably correct idea of the process of sugar refining; but the reader must bear in mind that in refineries, like all manufactories, constant improvements are being made; and almost in every refinery some special plan, either in one process or another, is adopted.

CHAPTER VII.

ANIMAL CHARCOAL, ITS USE AND TREATMENT.

THE employment of animal charcoal in sugar refining marks an era in that manufacture. As a colouriser in certain vegetable coloured solutions, the use of this material is almost magical, and in no case is its operation more remarkable than on coloured sugar. The agency of animal charcoal is commonly described as one of bleaching; a term, however, that gives an incorrect notion of what takes place; at least this remark applies to the employment of animal charcoal in sugar manufacturing. By bleaching is commonly understood the mere change of tint from coloured to colourless; a change occurring without loss of weight in the material operated upon; but when animal charcoal

changes yellow or brown to white sugar, it does so by actually removing a ponderable colouring material. Notwithstanding the prolonged use of this article in sugar refineries, it is not too much to assert that the theory of its action is not thoroughly known. The animal charcoal used in sugar works, consists of burnt bones, the pulverulent parts of which have been sifted away, the grainy portion only remaining. Animal charcoal in actual powder not answering for sugar refining, it does not admit of being packed in filter beds, so that the sugar solution to be decolorized may percolate with the needful facility.

It is a circumstance to be remarked, and it has elicited much speculation, that pure animal charcoal is much less efficient, as a deodoriser upon sugar, than the impure material that results from heating bones in close retorts. Such impure animal charcoal only contains about twenty-five per cent. of real charcoal diffused through seventy-five per cent. of bone earth, or phosphate of lime. The general opinion among chemists is, that the bone earth exalts the effect of charcoal by making it cover a larger surface than it would if unmixed: but this explanation is deemed insufficient by more than one writer who has studied the relations of animal charcoal to the sugar manufacture.

In London, and many other large towns, the burning and reburning of animal charcoal for sugar refining purposes, constitutes a trade of itself; but, occasionally, the manufacturer of sugar has to do this himself; therefore a few notes of procedure will be here advisable, and I trust interesting.

It is commonly assumed that new charcoal is more efficient than such as has been once or oftener used and reburnt; this, however, is not true, without some limitations. Charcoal, absolutely new, holds a considerable amount of matter soluble in water, and syrup, and which, if it mingles with saccharine liquor, materially interferes with its crystallization. The corollary is that new charcoals should not be placed in the filter tanks until they have been washed. This is a treatment, however, that they seldom receive in practice; hence the first syrups which come through are more or less deteriorated.

When the charcoal of a filter bed has accomplished its practical minimum of deodorization, water is poured through it until the fluid that comes away is no longer perceptibly sweet; then the charcoal being unpacked is sent to be reburned. The burning, so called, is more properly a distillation, the operation being always conducted in retorts either of iron or earthenware, from each of

which a small tube projects, through which latter the products of distillation are conducted. These products are chiefly ammonia in association with volatile unpyreumatic matter, and the operation is known to have been conducted long enough when the evolution of volatile matter ceases. This period having arrived, the extremity of each retort is unscrewed, and the charcoal being raked out into an iron tank, is accurately carried in such manner as to preclude atmospheric air. Prolonged contact of atmospheric air with glowing animal charcoal is very prejudicial, the result being an actual combustion of the charcoal; carbonic acid being evoked, and bone earth in excess, it may be, alone remaining. The burning of animal charcoal is a somewhat delicate operation. If the heat be too low complete evolution of the volatile matter will not take place; if too considerable the carbonaceous matter, reacting upon the phosphate of lime, evolves free phosphorus, the operation of which, in any considerable quantity, upon saccharine solutions, is ruinous to sugar.

CHAPTER VIII.

PRICES OF SUGAR FROM 1319 TO 1864, WITH NOTES ON SPECIAL FEATURES OBSERVABLE IN DIFFERENT YEARS.

INDEPENDENTLY of sugar being an article which, according to the natural order of things, has been gradually reduced from a very high cost to a very low one, it has been subject from time to time to extraordinary market fluctuations, which render the chronicle of the prices of sugar not the least interesting portion of its history. My present purpose is, therefore, to present the reader with an account of the prices which sugar has realised from its earliest introduction, and to accompany the market quotations with such incidental notices as will render what might be otherwise confounding, clear and intelligible.

One of the earliest records of the price of sugar in Great Britain appears in the accounts of the Chamberlain of Scotland, in 1319, in which it is set down at 1s. 9½d. (more than an ounce of standard silver) per lb. In 1459 sugar continued to be a great luxury, for in that year Margaret Paston, writing to her husband, who was a gentleman and landowner of Norfolk, begs that he "vouchsafe" to buy her a pound of sugar.

In the accounts of corporate bodies, and the household expenses of private persons, during the sixteenth and seventeenth centuries, the item of sugar appears from time to time. The following extracts will probably be interesting, but in noting the prices the reader must bear in mind the great difference in the value of money between those periods and the present. In the churchwardens' account of St. Mary at Hill, London, 1516, there is the following entry:—"At Cambridge's Obit., sugar, 1lb., 7d." In a list of viands provided for the funeral repast of Sir John Redston, Lord Mayor, in 1531, sugar is set down at 7d. lb. In the books of the Stationers' Company, 1554, there appears, "Item, payd for 10 lb. of curse sugar, 8s. 4d. Item, payd for 8 lb. of whyte sugar, 8s." In the same books, 1558, there is, "Item, payd for 16 pounde and an once of sugar, 18s." In the *Chronicon Pretiosum*,

1588, an entry appears of "10 lb. of sugar, 15s." In the Household Book of the Dean of Salisbury, 1625, there is set down "Pound of hard sugar, 16d.; of powder ditto, 14d." Again in the *Chronicon Pretiosum* there appears an entry in 1654, "7 lb. of sugar, 7s. 8d."

Thus far we obtain glimpses of the early prices of sugar, as applied to private consumption. The market value of this article a few years later is gleaned from Anderson's *History of Commerce*, which says, "At the Restoration of Charles the Second, the Parliament observing the great detriment which a sugar trade, open to all nations, did to the kingdom, confined it absolutely to our own people, by several acts of navigation; in consequence whereof the ports of London and Bristol soon after became the great magazines for sugar, for supplying that article to all the north and middle parts of Europe, reducing the Portuguese sugars of Brazil in time so low, as from eight pounds to two pounds ten shillings per cwt.; and so it remained until the French, in their turn, so greatly improved their sugar islands, as to be able to undersell us in most parts of Europe."

In the *Chronicon Pretiosum*, 1715, is "1½ cwt. sugar, £6 4s. 1748, 1 stone of sugar, 5s. 10d. In 1781, 1 stone of sugar, 7s. 10d." Beyond

these jottings it would afford but little interest to follow the prices of sugar during the period it was gradually coming into general use; it is easy to understand that as the demand became greater, and the duties were augmented, the prices made proportionate progress. Towards the end of the last century, however, when sugar, as an article of consumption, began to take rank next to corn, it became subject to those market fluctuations which are associated with the chief articles of the food of a people.

In the years 1792, 1793, and 1794 there was a great fall in the price of sugar, the effect of a recoil from extensive speculations which had their origin two or three years before. One of the chief causes of this speculation was an unusual scarcity of colonial produce, caused by the revolution in St. Domingo, which island at that time constituted the chief source of the supply of sugar.

In 1795 several circumstances combined to occasion a range of high prices. The scarcity of sugar, consequent upon the failure of supplies from St. Domingo, was now generally felt throughout Europe; in the two following years it experienced a fresh rise, and continued to advance till the close of 1798. At the end of the latter year and the commencement of 1799 it reached a greater height than at any subsequent period between that and 1814.

The following quotations will afford a clue to the prices during the years mentioned:—

	1793-4.	1798-9.
Muscovado	32s. to 58s. per cwt.	62s. to 87s.
East India White ...	60s. to 70s. do	96s. to 115s.

From the spring of 1799 to the spring of 1801 there was a great fall in the prices of colonial produce, and at this period sugar reached its extreme point of depression. This will be best shown and explained by the following extract from the printed commercial reports of that period:—"October 1st, 1799. The trade of this country with the principal part of Europe having of late been confined almost wholly to one channel, the unusual flow of business it produced to those places through which it was carried on led many persons to extend their trading in a degree to which their capital was inadequate, encouraging a spirit of adventure and speculation, particularly in the article of sugar, which has at length been carried too far. The consequence has been the failure of some considerable houses at Hamburgh and other places, which has affected their connections in this country, so far as to cause the stoppage of several houses which had hitherto maintained no small degree of commercial reputation."

The losses connected with these failures, and the

great fall in the prices of West India produce, seem to have been felt with peculiar severity in Liverpool. In proof of which the following Act was passed in the session of parliament of 1799, granting a loan of £500,000, in Exchequer bills, to the West India merchants in Liverpool, in order to avert the ruin which hung over their heads from the very heavy failures in Hamburgh. Security was given for this loan in property lying in their warehouses, amounting to upwards of £2,000,000. Subjoined is a statement showing the extreme depression of prices between the spring of 1799 and the spring of 1801 :—

	1798-9.	1800-1.
Muscovado Sugar ...	62s. to 87s. per cwt.	28s. to 50s.
East India White ...	96s. to 115s. do	50s. to 70s.

The next three or four years exhibit a slight improvement, and prices may be said to have advanced till 1805. In 1806 and 1807 the decrees of Berlin and Milan, by narrowing the channels of export, depressed the article, and comparative stagnation ensued. In 1810 and 1811 prices rose a little, in consequence of shipments to the Baltic, which were mostly confiscated when they reached their destination. The annexed quotations show the range of prices during the years mentioned :—

	1807.	1808-9.	1810-11.
Muscovado	31s to 38s. per cwt.	36s. to 50s.	35s. to 54s.
White Havannah	40s. to 46s. do	36s. to 65s.	30s. to 75s.

Notwithstanding the slight upward tendency shown in the spring of 1811, the sugar trade would appear to be in a very depressed state at this period. In January 1811, at London, Liverpool, and Bristol, the King's stores were full of all kinds of colonial produce, held as security for the duty, and the proprietors were in the greatest possible distress, not being able to force sales at any price. The following extract is from the Report of a Select Committee of the House of Commons, appointed to enquire into the state of commercial credit, dated March 7, 1811:—"It appeared to your Committee that the present prevalence of commercial distress complained of has arisen out of the extensive speculations which followed the opening of the South American markets in the Brazils and elsewhere. Your committee also found that great distress was felt in a quarter which was much connected with the trade, namely, among the importers of provisions from the West India Islands and South America. That a great part of the returns for goods which had been exported to these parts came home in sugars, which not meeting with a sale in the home market, left no means of realising their value."

By way of episode, it may be mentioned that about this period, England being at war with France and Germany, had the effect of raising the price of sugar in those countries to an almost incredible extent. It will be easily understood that the vigilance of the enemy was chiefly directed against exports from England, and the following instance is given of one among many of the means devised to overcome the obstacles which presented themselves. Several vessels, laden with sugar, which was packed in small boxes, for easier transport, were despatched from the coast at very high rates of freight to Salonica, where the goods were landed, and were thence conveyed on horses and mules through Servia and Hungary, to Vienna, for the purpose of being distributed over Germany, and possibly into France. Thus it was that the inhabitants of that part of the continent of Europe, nearest to this country, could not receive their supplies from us without incurring expense of conveyance equivalent to what it would be if they were removed to a distance of a sea voyage twice round the globe, but not subject to fiscal and port obstructions. It is not to be wondered at, therefore, that sugar subject to these extraordinary charges rose to the enormous price of from 5s. to 6s. per pound.

Towards the close of 1812, sugar began to rise, and continued to do so till the spring of 1814, the ports on the Continent having been in the meantime opened. It will be seen by the following quotation that in the last mentioned year, the sugar trade was in a most flourishing condition:—

	1811-12.	1813-14.
Muscovado—Gazette average	34s. 11d. per cwt.	97s. 2d.
Havannah, white	30s. to 46s. do.	110s. to 134s.

The extraordinary encouragement which the realisation of these prices gave to demand soon occasioned an excess of importation, a consequent fall in prices ensued, attended by the most disastrous results in the two succeeding years, as the subjoined figures will show:—

	Highest price in 1813-14.	Lowest price in 1815-16.
Sugar, Gazette Average	97s. 2d. per cwt.	45s.
Havannah, white	110s. to 134s. per cwt.	44s. to 50s.

This state of things did not, however, continue long. The years 1817-18 exhibited once more a great advance in prices, owing to the limited imports of the two preceding years, and a very heavy fall in stocks. Then followed an enormous increase of importations, consequently the prices of sugar became depressed early in the year 1819, and continued with a downward tendency till 1822.

From 1823 to 1826, sugar was subject to

fluctuations. A commercial circular of November, 1824, recommended sugar to be bought, and spoke of a probable advance of from 10 to 25 per cent. This prediction was fulfilled. But towards the close of 1825 a downward tendency was again exhibited, and existed in a still greater degree in the early part of 1826.

	July to Nov. 1824.	Dec. 1824, to June 1825.	June 1825, to Apl. 1826.
Sugar, Brit. Pos. Gaz. Av.	29s. 11¾d. per cwt.	41s. 5d.	28s. 9¼d.
Havannah, white	35s. to 40s. do.	49s. to 55s.	38s. to 42s.

During the above period occurred that panic in commercial circles, when the failure of banks became an every-day incident, and many old-established commercial firms were declared insolvent.

Between the years 1828 and 1832, the prices of sugar fell to the lowest point of depression, the quotations for White Havannah during that interval ranging from 26s. to 34s.

In the early part of 1833 there was, as there had been in the spring of 1823, a speculative advance in the price of sugar, and up to 1836, the trade was sound and active. The close of the last-named year, however, witnessed another serious fall in prices, and during the spring and summer of 1837 there was a depreciation of 50 per cent.

In the autumn of 1837 the trade rallied, but as the season came forward, the prices could not be

maintained. The following are the quotations for 1838 and 1839:—

	August 1838.	August 1839.
Jamaica sugar	60s. to 62s. 6d. per cwt.	65s. 6d. to 68s.
Mauritius	44s. to 51s. do.	59s. to 62s. 6d.
East India (Bengal)	55s. to 59s. do.	60s. to 65s. 6d.

From 1839 to 1844—a period of national distress—the markets exhibited a downward tendency, as the annexed prices will show:—

	1841.	1844.
Muscovado	44s. 10½d. per cwt. ...	34s. 10d.
Havannah, white	30s. to 33s. do. ...	25s. to 32s.

The trade in the three following years may be gleaned from the following:—

	Sept. 1845.	Sept. 1846.	Sept. 1847.
Muscovado	35s. 11d. per cwt.	32s. 5d.	26s. 4d.

In 1849, there sprung up an evident tendency to a speculative rise in price. In 1850 the standard remained much the same, the fluctuations not being greater than 1s. or 2s. per cwt. It is to be remarked that in the early part of this year expectations were entertained of large supplies during the season from several places of produce, particularly from Cuba. These expectations were not fulfilled. In 1851 there was a great fall in all commodities, in which sugar shared, the price being 25 per cent. lower than in the previous year, so low, indeed, that in November 1851, the quotations

of sugar are from 18s. to 26s.; this fall in prices continued throughout the year.

January, 1852, witnessed a panic which will long be remembered, and during the early part of the year prices had reached their lowest. The summer of 1852 and 1853 showed an improvement, thus:—

	April 1852.	July 1853.
Brit. West India Sugar... ...	17s. to 27s. per cwt.	21s. to 28s.

Stagnation prevailed in 1854. But 1855 saw an extensive advance in the prices of sugar, and consequent speculation, founded principally upon well ascertained facts of the failure of the West India crop. The prices and sales of sugar in 1855 and part of 1856 afford striking illustrations of the fluctuations to which foreign produce is liable.

The sugar mania of 1855 was based entirely on *short stocks*, assisted by a mad speculation entered into not only by capitalists out of the market, but by the whole trading community, from the merchant importer to the small retail grocer. In the early part of April, 1855, sugars of all descriptions were selling below their value, brown lump sugar only realising 42s., which was a fair price compared with raw for refining purposes; from that time till about April 21, the market gradually stiffened to an advance of 6d. to 1s., principally in consequence of a report that an increased duty would be levied.

Between the 21st and 28th a rise of 2s. 6d. to 3s. was established, from the anticipated alteration in duties being realised, coupled with heavy clearances and decreasing stock; the following fortnight produced a further advance of 6d. to 1s., with imports 10,000 tons less, deliveries for home consumption 22,000 tons in excess, exports 2,200 more, and stock 17,000 tons less, than corresponding period in 1854. The market continued firm throughout May and first week in June. Brown lump sugar sold at 47s. 6d. to 48s. From that time till about the middle of July the market was inactive, with a decline of 1s. to 1s. 6d. On July 3, the stock of sugar was 84,000 tons, against 114,000 tons in 1854; about the 13th the market gave symptoms of steadiness, and the week following 1s. advance was established on sugar suitable for refining purposes, with a firm market for grocery sugar.

Imports at this time were 12,121 tons less than same period 1854; the market continued to advance steadily till the early part of September, when there was a rise on all descriptions of 1s. 6d. to 2s. in the week, with imports declining—stock 26,600 tons less than in 1854—greatly reduced stocks throughout Europe, and beet sugar manufactories in France 96 less in number than in 1854. In the week ending September 8, pri[illegible] were fully

maintained, brown lumps sold at 50s., and the stock was 28,354 tons less. The week following, another rise of 1s. 6d. to 2s.; stock minus 35,593 tons, and deliveries increasing. From this time to the week ending October 6, the market continued gradually to strengthen, and stock had become 43,146 tons less than previous year. The week following, a decline (without a traceable cause) of 6d. to 1s. took place; the next week the market recovered, from the fact of deliveries increasing, and stocks decreasing. In the week ending October 27, an advance of 1s. 6d. was recorded, with stocks still decreasing, and deliveries 26,445 tons in excess of previous year. On October 30, the market became very excited, and continued in the same state till November 13; most descriptions of sugar having advanced in the meantime 20s. per cwt., brown lump sugar having realized 72s. 6d., and grocery 74s. 6d. to 77s. From that date to the commencement of 1856 prices were nominal, no trade doing, and when transactions took place it was on a minimum scale, at a decline of over 20s. per cwt. For the week ending November 10, the stock was 63,000 tons, against 151,000 tons in 1854; and the home consumption was 194,470 tons, against 171,710 tons in 1854.

In 1856 there was a deficient supply of the

sugar crop, and prices were influenced accordingly. The following are the periodic quotations for the three years named.

	April 1854.	July 1855.	Oct. 1856.
Brit. West India Sugar	21s. to 29s.	20s. to 25s.	28s. to 33s.

In the years 1857 and 1858 there was a great increase of consumption and a slight diminution in general stocks, and from the absence of speculation the fluctuations of the market throughout this period rarely exceeded 1s. or 2s. per cwt.

In 1859 there was again an increase of consumption, and the fluctuations in the market were gradual. In the spring of this year prices slightly advanced, but the war on the Continent suddenly appearing imminent, there followed a depression. In the summer, owing to an expectation of increased duties, there were some large operations, and a consequent rise in prices; but in the autumn large quantities of foreign sugar were forced upon the market; and towards the end of the year brown raw was quoted at 36s., and brown lumps at 47s. 6d.

The year 1860 witnessed considerable activity in the sugar market. Large purchases were made, based on the ascertained deficiency of the produce of Louisiana and Brazil, and also in anticipation of lowered duties. This buoyancy was, however, but

temporary, for during the spring and early part of summer prices fell, and by the middle of June had receded 2s. to 3s. per cwt. In the autumn, from the undisputed evidence of limited supplies, coupled with the fact that owing to the high price of malt, brewers would consume large quantities of sugar, prices rose, and by November were 3s. to 4s. above the lowest quotations. Shortly afterwards, however, the Bank raised its rate of discount—speculation subsided, and prices gradually declined to the close of the year.

The most observable feature of 1861 was the continued quietness and downward tendency of the sugar market, produced not by any falling off in consumption, but from excessive stocks and the abundant supplies from Mauritius, the British West Indies, Cuba, and Porto Rico. In October the stocks in the United Kingdom were 36,000 tons in excess of the same period in 1860, but it was reduced to 34,900 tons by the 31st December. The high rate of discount which ruled at the commencement of the year tended materially to aid the depression, as also our relations with the Federal States not being so amicable as could be wished. The decline in prices at the end of the year, in comparison with January 1, were 3s. to 4s. per cwt. on common and brown sorts, and

1s. 6d. to 2s. 6d. per cwt. on middling to fine qualities.

The unfortunate struggle in America caused sugars to arrive here in such extra quantities as to enhance the weight of stocks materially at the commencement of 1862 and throughout the year. At the principal continental ports the stocks were some thousand tons in excess of the two preceding years. When the markets opened in January there was but little disposition to purchase, and prices were 3s. per cwt. lower than at the same period in 1861, and 4s. per cwt. less than were procurable in 1860. Under these circumstances transactions were conducted with the greatest care, notwithstanding an estimated deficiency of 20,000 tons in the Mauritius crop, and a feeling in well-informed circles that there was but little margin for lower rates.

In February the flatness that had been observable up to this period was increased in the raw market by refiners' produce being 1s. per cwt. cheaper comparatively than raw, and 1s. per cwt. dearer than it was in 1861, whilst the Gazette average was 3s. per cwt. lower, this further induced purchasers to be very scant in their requirements. From this period to July there was neither speculation nor activity, the mere wants

of the time being here apparently the only transactions. Two facts that are noticeable in this year are the great falling off in the imports of bags and mats of crystallized sugars, and the great increase in consumption of refiners' goods known in the trade under the names of pieces and bastards, the production of which made Greenock notorious for Scotch pieces.

About the middle of July prices slightly improved, but the advance was not maintained, for in October prices had so continuously declined that several refiners ceased working. Flat and drooping markets continued to the end of the year, at the close of which prices had declined 2s. to 3s. per cwt. from the lowest point in January.

From the shifting nature of affairs both on the Continent and in America, great caution was exercised in the purchasing of sugars. Buyers argued that if the American war was protracted it would leave available large quantities of sugar for this country, whilst sellers advanced their claims to be heard on the ground, that if peace was suddenly proclaimed on the other side of the Atlantic, the Americans would immediately become strong buyers. The result of the markets was for some months in favour of purchasers, the state of affairs in Lancashire assuming such a woful mag-

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nitude, with stocks of sugar increasing both here and on the Continent, that depression continued for so long a time as to almost become chronic.

In September the lowest prices were reached, when a new phase introduced itself into the market, and the result was an advance of fully 11s. to 12s. per cwt. between that time and the end of December. The advance in price was traceable much more to the possible contingencies of future supplies than to any deficiency in the then existing stocks. In the early part of September the stock was 113,902 tons, being 27,190 tons in excess of the quantity on hand at the corresponding period in 1862; the stock at the latter part of December was 76,276 tons, which showed a surplus of about 10,000 tons over that held at corresponding time in 1862. The first movement was caused by purchases on account of French speculators in the principal European markets, to the extent of 100,000 tons. At the same time a demand arose for America. Reports immediately circulated that the beet crops of the Continent were 60,000 to 80,000 tons deficient, and that the stocks of sugar on hand in America had been reduced in one month (September) 25,000 tons. These reports were supplemented by the assertion that growing crops of Reunion, Louisiana, and Brazil would be 40,000 tons each less than the

average. The deficiency of the Mauritius crop last year was also estimated to be 30,000 tons, and it was confidently asserted that China would take the whole of the Manilla produce.

These statements, and the enormous sums of money which were launched in Mincing-lane by speculators fully account for the rise.

The year 1864 was one of considerable importance in the sugar trade, and rivals most of its predecessors, an additional interest having been imparted by the new channel of commerce that was thrown open in admitting foreign refined into this country at a lower rate of duty, which has led to results of quite a revolutionary character. Other circumstances likewise united to produce a widely different state of things to what had been calculated upon. Among the chief were the liberal arrivals and enormous stocks throughout the kingdom, which caused great disappointment to holders who looked forward to highly prosperous times; but to buyers, and more particularly the grocers, who were preparing for a period of short supplies and inflated prices, as prophesied by some of the best authorities, they have proved a positive boon as well as a startling surprise. The direct consequence of this entire change in the position of the article has been a serious revulsion in value, completely

obliterating all traces of that wild speculative mania which swept over the market in the latter part of 1863, and besides the average remission of 4s. in the scale of duties, there was a fall in quotations of 6s. to 10s. per cwt. from the highest point at the commencement of April. The effects of the high rates ruling were first apparent in January, when the deliveries became much contracted, and with several parcels in second hands, sales pressed in anticipation of prompts, resulted in a decline of 3s. to 4s. In the two following months the imports continued scanty, the total quantity afloat being stated as 50,000 tons less than in the same period of the previous year, and the home trade operating freely under immediate orders, in conjunction with some speculative inquiry, a reaction of 2s. to 3s. per cwt. ensued. This improvement was succeeded by general agitation with regard to the settlement of the long-delayed question of the sugar duties, and in the suspense that was felt by all parties, business was brought to a standstill. The announcement of a reduction of duty by the Chancellor of the Exchequer, not only in accordance with the views of the more advanced free-traders, but beyond the expectations of even the most sanguine, gave almost universal satisfaction, and was instantly followed by decided flatness in the refined market.

Upon calmer reflection, and after the proposed new duties had been made law, it was discovered that the competition between the English and foreign refiner would be very formidable, greatly surpassing anything of the like that had ever before been experienced, and as foreign loaf sugar kept continually arriving from the Continent in large quantities, and constituted the bulk of the duty-paid entries by the grocers, in their anxiety to get into stock, the British refiner seemed to be nearly shut out, and several houses altogether stopped working rather than incur heavier losses. By this means the demand for raw descriptions was materially curtailed, speculation ceased, while numerous cargoes of Havana, Cuba, &c., began to arrive off the coast; and the Bank rate of discount about this time being 9 per cent., prices, notwithstanding the efforts of holders to keep them up, receded to the lowest point of December, 1863. In June it was reported that the breadth of beet-root under cultivation was extraordinarily large, and extensive purchases took place for delivery in the last three months of the year, on terms equal to 28s. to 28s. 6d. f.o.b. The complicated nature of Continental politics at this period also contributed to increase the prevailing heaviness, and the predictions of scarcity being rendered false by the occurrence of heavier landings

and accumulating stocks, a further important depreciation was established by the early part of August. Shortly afterwards, reports of injury to the growing crops of beet in France, through drought, enabled sellers to obtain an advance of 1s. to 1s. 6d. per cwt.; but as no unfavourable accounts came to hand from other quarters, this recovery shortly disappeared. For a few weeks afterwards, it was, nevertheless, uncertain what the out-turn from this source of production would actually be, though by degrees it was admitted that the deficiency on the original estimate respecting France (of which no doubt existed), would be more than compensated by the successful gathering in Germany and other places.

For the information of my readers I append a list of the principal European crops in tons for the past five seasons, viz.:—

	1860-1.	1861-2.	1862-3.	1863-4.	1864-5. estimated.
Germany (Zollverein)	117,000	116,000	128,000	142,000	157,000
France	93,000	136,000	161,000	99,000	139,000
Austria	56,000	50,000	68,000	57,000	88,000
Russia	50,000	45,000	28,000	32,000	37,000
Belgium	13,000	17,000	20,000	19,000	21,000
	329,000	364,000	405,000	349,000	442,000

Such a comparison as the above figures afforded was not likely to inspire confidence; and supplies of cane sugar during the latter months being more

plentiful than in the corresponding period of 1863, and the clearances of raw lighter, the amount held in London was mostly augmenting; so that, instead of showing a striking diminution, as in the earlier part of the year, there was a comparative surplus in December of about 37,000 tons. This strongly confirms the opening remarks with regard to the excessive weight of the available supply; and to better illustrate the reversed course of the article in this particular, I have compiled the subjoined statement from official returns as relating to the stock in the United Kingdom:—

January.

	1864. tons.	1863. tons.
Raw	133,095	113,396
Foreign Refined...	4,291	3,716
	137,386	117,112

February.

Raw	113,644	101,919
Foreign Refined...	3,986	4,629
	117,630	106,548

March.

Raw	105,685	115,717
Foreign Refined...	3,738	4,917
	109,423	120,634

April.

Raw	105,419	127,559
Foreign Refined...	6,538	4,679
	111,957	132,238

May.

	1864. tons.	1863-4 tons.
Raw	110,149	141,257
Foreign Refined...	5,548	5,261
	115,697	146,51[illegible]

June.

Raw	127,598	170,081
Foreign Refined...	7,976	5,255
	135,5[illegible]4	175,336

July.

Raw	143,254	179,621
Foreign Refined...	11,308	5,078
	154,562	184,702

August.

Raw	162,842	211,733
Foreign Refined...	14,200	5,591
	177,042	217,324

September.

	1894. tons.	1863. tons.
Raw	191,457	203,381
Foreign Refined...	15,066	5,234
	206,523	208,615

October.

Raw	207,740	180,377
Foreign Refined...	12,621	4,869
	220,361	185,246

November.

	1864. tons.	1863. tons.
Raw	225,000	151,890
Foreign Refined...	12,000	4,413
	237,000	156,303

December.

Raw	217,000	148,501
Foreign Refined...	10,500	4,650
	227,500	153,15

Until the present year, the stocks on hand in 1863 were the largest on record. With statistics demonstrating so forcibly the abundance of the article, whether Raw or Refined, the manufacture of cane or beet-root, it was impossible for any tone but that of severe depression to prevail, and in the urgent transactions by speculators for cash during September, the concession in value was somewhat alarming: moreover as evidencing the ruinous extent of the collapse, it may not be uninteresting to note the prices paid for the undermentioned kinds at the two extreme points, viz.:—

At the Highest Period of the Old Duty.

Mauritius. Brown.	Mauritius. Yellow grainy.	Gurpatta. Bengal.	Clayed. Manilla.	Havana. No. 12.	Porto Rico. Good&Fine
34/6 to 43/	44/ to 51/	42/ to 45/	42/ to 43/6	46/	48/ to 49/

At the Lowest Period of the New Duties.

25/ to 29/6	33/ to 38/	31/ to 33/	28/6 to 29/6	35/6	[illegible]

Even these reduced rates failed to encourage buyers, the terms for discount being against any renewed attempt at speculation; and it was not until exporters had been some time in the market, picking up the cheapest parcels, that the London refiners, to meet the improving local demand that was arising for pieces, &c., in December, resolved to operate with their accustomed freedom, which caused business to assume a scale of unusual magnitude for the season of the year, at a gradual advance on the suitable brown sorts of 1s. per cwt. from the lowest range; but the grocery kinds, continuing in the same partial request, were saleable only at still easier prices, being in a few instances below those above quoted.

CHAPTER IX.

DUTIES IMPOSED UPON SUGAR FROM 1661 TO 1864; TABLES OF NET REVENUE; AVERAGE RATE OF DUTY; AVERAGE PRICE IN BOND, AND AVERAGE PRICE INCLUSIVE OF DUTY FROM 1801 TO 1864; AND THE DIFFERENT RATES OF DUTY ON UNREFINED SUGAR DURING THE SAME PERIOD.

ORIGINALLY, sugar, as all other imported articles, paid a "poundage" duty, or five per cent. on the declared value. In 1661, a duty amounting to 1s. 6d. per cwt. was imposed on the importation of British plantation sugar in England; and in 1669 the duty was doubled. In the first year of King James the Second (1685) new duties on sugar were levied, and the Chancellor of the Exchequer of the time estimated the probable revenue on sugar and tobacco coupled at £200,000 per annum.

From 1703 to 1747 the duty was 3s. 4d. per cwt.; from 1747 to [illegible] 10d.; from 1759

to 1779, 6s. 4d.; and from 1779 to 1781, 6s. 8d. In 1787 a considerable addition was made to the duty, as it then became 12s. 4d. per cwt. In 1791 it was raised to 15s.; and while its extensive and increasing consumption pointed it out as an article well fitted to augment the public revenue, the pressure on the public finances caused by the French war, occasioned its being loaded with duties. In 1797 the duty was raised to 17s. 6d.; two years afterwards it was raised to 20s., and by successive augmentations in 1803, 1804, and 1806, it was raised to 30s.; but in the last-mentioned year it was enacted that, in the event of the market price of sugar in bond, or exclusive of the duty, being for the four months previous to the 5th of January, the 5th of May, or the 5th of September below 49s. per cwt., the Lords of the Treasury might remit 1s. per cwt. of the duty; that if the prices were below 48s. they might remit 2s.; and if below 47s. they might remit 3s., which was the greatest reduction that could be made. In 1819 the duty was fixed at 27s., and in 1832 it was reduced to 24s. per cwt.

Meanwhile distinctive duties were charged on other kinds of sugar. Thus from 1793 to 1803 the duty on East India sugar was 37 and 38 per cent. ad valorem, and afterwards was 11s. and 8s.

to cwt. higher than the duty on West India. By an act passed in 1836 the duties were assimilated by the reduction of East India sugar from 32s. to 24s. the cwt. The duty on foreign sugar was 63s. per cwt.

Alison in his *History of Europe*, says:—"It may seem strange how this enormous and crushing system of taxation on rude produce could have come to be imposed, the West India influence in the then Parliaments being very great. But the reason was that the burden of the tax was not felt by the producer, when under an adequate currency sugar fetched high prices; and this tax, thus wholly paid by the consumer, still left an ample profit to the producer. When prices fell, the profits of the cultivator were entirely extinguished. This, however, did not lead to a diminution of production, but to a great increase. This was the true cause, that in all the West India islands, except Antigua and Barbadoes, there had been for seven years previous to 1833 an increase in the produce of sugar, and a decrease in the number of slaves, this increase of production tending still more to depress prices, and annihilate the profits of the cultivator."

It will be seen that the rates of duty during the foregoing years were continually shifting and varying; the object of these fiscal experiments was to

increase if possible the supply without infringing on the virtual monopoly of the West Indies.

We come now to the year 1841, when the famous Sugar Debates took place in the House of Commons, Lord George Bentinck and Mr. D'Israeli representing protection and monopoly, while the premier, Lord Melbourne, and the Chancellor of the Exchequer, Mr. Labouchere, espoused the opposite cause. Up to this period the principle of protecting and fostering the colonies was adopted as the rule for fixing the duties on sugar, and this principle was carried out to an extent varying according to the colonies to be favoured. But it was now considered high time to level these distinctions to a certain extent, and, accordingly, the Chancellor of the Exchequer in opening his budget proposed that the duty on colonial sugar should remain at 24s. per cwt., but that the duty on foreign sugar should be lowered from 63s. to 36s.

The announcement of this budget created a great sensation in the sugar trade, and opposition meetings were held by the monopolists in London, Liverpool, Bristol, Glasgow, &c. The result was disastrous to the ministers, for after a debate of eight nights they were in a minority of 36, and subsequently Parliament was dissolved.

It is curious to note at this distance of time the arguments against free trade, made use of on this occasion by Sir Robert Peel, who afterwards identified himself so intimately with the very principles which he here denounces. In the course of his speech against the budget, he said:—"Even though no question of timber or corn had been mixed with that of sugar, I would have voted against the introduction of slave-grown sugar into the English market; not upon the abstract ground that conscience should forbid all commerce in the produce of slave labour, but upon a consideration of the social and moral condition of the West India people under the experiment now in progress. If the personal interests of the planters alone were taken into consideration, the House might possibly expect them to sacrifice those interests to the public advantage. But much higher interests were at stake in the moral and social condition of the people in that part of the empire where we had recently made the most hazardous experiment in the annals of the world. But it is impossible to foretell what may be the consequences of that step, if we take the new step of introducing sugar made by slave labour into the market of this country. A sufficient quantity of sugar for home consumption may be obtained from the East and

West Indies and the Mauritius without resorting to the slave colonies. New articles of remittance should be encouraged from India, for its inhabitants have suffered severely from the unrestricted admission of English manufactures. . . . After such fearful examples, I am unable to perceive the paramount objections of those *free-trade doctrines* which now demand a preference for the slave labour of Cuba and Brazil over the free industry of the East Indies. The principle of free trade announced on the other side is, that without reference to any other considerations we should go to the cheapest market. If that is to be acted upon as a universal rule, without reference to time and circumstances, I can only say, *I cannot concur in it.*"

In the year 1844, the Chancellor of the Exchequer having a large surplus, several duties were proposed to be lowered or remitted. The duties on sugar were made the subject of a separate debate of great interest, as affording demonstrative evidence of the effect which, after a trial of six years, the emancipation of the negroes had produced on the productive industry of the once splendid West India Colonies. It was stated by the Chancellor of the Exchequer, that, before the Emancipation Bill, the West Indies had produced sugar enough for the consumption of this country, and about a third

more, which was exported, which had the effect of keeping down the price of the whole to the level which that surplus could command in the market of Europe. When emancipation, however, took place it was foreseen that the supply would be considerably diminished, and to meet that probable event, Parliament brought the duties on East and West India sugar nearer to a level. Experience had proved, however, that this arrangement was not equal to the exigencies of the case, especially as the improved condition of the people in Great Britain and our altered relations with China rendered it probable that an increased consumption of sugar to mix with tea would take place. For this purpose it was now proposed, that the free-grown sugar of China, Java, Manilla, or any other which might be certified to be not slave-grown sugar, should be admitted at 34s. per cwt., with 5 per cent. additional, being 10s. more than the duty of 24s. on West India sugar. To this proposal, Parliament cordially agreed, the necessity of the case, from the diminution of West India sugar, being apparent to all. Indeed, so strongly was it felt, that Lord John Russell boldly moved an amendment that *slave-grown* sugar should be admitted to supply the deficiency of the West Indies, which was negatived by a majority of 69.

Thus was the first step in advance made to free-trade in sugar.

In 1846, Lord John Russell brought forward his measure for the further reduction of the sugar duties. The question was agitated from one end of the kingdom to the other; it was discussed by orators, argued by statists, and written upon by essayists, pamphleteers, reviewers, and newspaper writers. The term "slave-grown sugar," became a party cry, and the admission or prohibition of the commodity was made a universal bone of contention.

With regard to the inconsistency of objecting to the produce of slave labour, as applied to sugar only, Lord John Russell used the following pertinent arguments. He says:—"The argument so strongly rested on by the Protectionists—that if you admit foreign slave sugar, on anything like an equality with British free-grown, you give an encouragement to slavery—though specious in appearance, has no solid foundation. No such bar as is contended for in the case of sugar, is imposed upon slave produce in other articles, as cotton, tobacco, copper, and many others. Nobody can deny that the vast consumption of these articles, especially the two first, in this country, gives an impulse to slavery in the United States; but has

any one yet been bold enough to affirm, that before admitting the American cotton into our harbours, we must insist on their solving the tremendous problem hanging over their heads in the United States, and emancipating all the negroes by whose hands the cotton has been raised? Such a proposal would be little short of insanity; and yet if there is any foundation for the argument, that we should keep up the heavy import duties on foreign slave-grown sugar, to discourage slavery, we unquestionably, to be consistent, should apply the same principle to American slave-grown cotton."

The plan proposed by Government was, that instead of the prohibitory duty of 63s. the cwt. on foreign slave Muscovado sugar, and 23s. 4d. on foreign free-labour sugar, there should be imposed for that year, a duty of 21s. on all foreign sugar, whether the produce of free or slave labour, the duty to fall progressively to July 1851, when it should be permanently fixed at 14s. The following was the rate of decline:—

To July	1847 . . .	21s.
,,	1848 . . .	20s.
,,	1849 . . .	18s. 6d.
,,	1850 . . .	17s.
,,	1851 . . .	15s. 6d.
After July	1851 . . .	14s.

This proposed measure met with violent opposition from Lord George Bentinck, Mr. D'Israeli, and other exponents of protection, as well as from Lord Brougham and Daniel O'Connell in the interests of anti-slavery. Sir Robert Peel supported the bill, not, as he said, because he approved of it, but in order that the ministers might not be forced to resign through defeat. The measure was ultimately carried in the House of Commons, by a majority of 130; and in the House of Lords by a majority of 18 with only 28 members present.

In 1847, a modification of the sugar duties, as applied to distilleries and breweries, took place; one of the subsequent results of which was that in the year 1860, no less a sum than £54,000 was received for sugar used in breweries as a substitute for malt.

The withdrawal of the protective duties on sugar produced, as may be supposed, a panic in our sugar-growing colonies. In the Mauritius, a commercial crisis disorganised the island and rendered the interference of Government necessary. Its economical state had been unsound, and propped up by fictitious credit, so that when it came to be exposed to a severe trial, its weakness was disclosed. Much benefit was derived from emi-

gration from India. Various measures, suggested by the Mauritius Association of London, involving advances of public money to traders, and the issue of a colonial paper currency, were likewise adopted; but it was not till after a long and bitter struggle had been gone through, that a substantial improvement presented itself in the island. In St. Lucia and Trinidad the distress was almost as great, and to ease the diminished resources of the islands, a reduction of 25 per cent was made in all salaries charged on the Civil List. Jamaica, our largest West India island, whose colonization dates from the time of Cromwell and Charles II., was, however, the chief sufferer by these changes. For some years after the bill was passed, the planters made immense efforts to compensate the reduction of price by increase of production; but with all their energy and perseverance, the next three years showed a falling off of 360,000 cwt. Finally, the Jamaica Assembly memorialised the Queen, but failing in this, the island sank into an idle and listless condition, from which it has not since recovered.

The duties proposed in 1846 continued in force till the 10th of July, 1848, when they were repealed and replaced by new and reduced duties, introducing a further distinction of quality for sugar, not the produce of and imported from British posses-

sions into which foreign sugar was prohibited, under the title of "not equal to brown clayed;" and like the former measure provided for the eventual equalisation of foreign and colonial rates, by annually diminishing the difference till it disappeared in July, 1854. Shortly before this equalisation was to take place the Russian war broke out, and the increased expenditure entailed by that event rendered increased taxation necessary. It was hence determined to raise part of the augmented revenue from sugar. On the 9th of May 15 per cent. was added to the duties then existing on sugar; and subsequently the Act of 1854 instituted the system of one scale graduated according to quality, but applicable to all sugars, of whatsoever growth, and whencesoever imported. The rates then established were:—Refined, from 5th of July to 2nd of August, 17s. 4d. per cwt., from the 2nd of August, 16s. per cwt.; equal to white clayed, not equal to refined, 14s. per cwt., equal to brown clayed, not equal to white clayed, 12s. per cwt., and not equal to brown clayed, 11s. per cwt. In the year following, 1855, the extent of the war expenditure calling for greater resources, the sugar duties were again increased to the extent of an extra duty of 3s. per cwt. The Chancellor of the Exchequer observing, "This extra duty will not raise the cost of sugar

to the consumer beyond 1s. higher than it was in 1854, and the price will still be 10s. 5d. less than it was in 1846."

In 1857 Sir George Lewis, then Chancellor of the Exchequer, proposed and carried the following alterations in the sugar duties:—The duty on refined sugar to be reduced from 20s. to 18s. 4d. in 1858; 16s. 8d. in 1859, and to 13s. 4d. in 1860; on brown sugar from 13s. 9d. to 12s. 8d. in 1858; 11s. 8d. in 1859, and to 10s. 7d. in 1860.

In 1860 Mr. Gladstone purged the tariff from a large proportion of import duties. Fifteen articles only being virtually retained for the purposes of revenue. Sugar was one of these articles; and the duty, as it then stood, was renewed for fifteen months.

No alteration was made in the sugar duties in 1861, and they were reimposed for one year.

The duty was continued in 1862, on the plea that any change made ought to be the result of careful consideration and protracted investigation by those interested in the matter. Shortly after this declaration Mr. Crawford, in the House of Commons, moved for "a select committee to inquire into the operation of the present scale of Sugar Duties." He said that these duties were levied in 1854 upon the principle of appraisement

of the quality of the sugar, according to standards in the possession of the authorities. In the period which had since elapsed sufficient experience had been gained to test the validity of the objections expressed with respect to the system in operation. There was, however, considerable difference of opinion upon the subject. On the part of the growers and producers of sugar in the East Indies, great objections were taken to the principle of appraisement of the quality of the article. On the other hand, certain domestic interests were content with the present state of things. The refiners objected to any alteration, but the consumers, represented by the wholesale grocers, wanted a change. To investigate this matter a committee was appointed, which included the names of Sir John Pakington, Messrs. Crawford, Cardwell, Thomas Baring, Cave, Dunlop, Crum Ewing, Gregson, Hankey, Moffatt, Potter, Turner, Tollemache, Allen Bathurst, and Vance. The report of the committee was to the effect—That a uniform duty was not applicable to all classes of sugar—that it was necessary to maintain the principle of a scale of duties—and that the existing scale might be made more equitable, by such an alteration as should admit, at lower relative rates of duty, the inferior portions of the sugars, which

were then liable to pay 12s. 8d. and 16s. respectively.

In 1863 the sugar duties were again retained for another year. In bringing forward the Budget of that year, Mr. Gladstone compared the arguments for and against the claims of sugar and tea respectively; and said that, while the duty on tea was more than 100 per cent. on the value of the article, the duty on sugar was only half the value; it was, therefore, decided to reduce the duty on tea, and to leave the duty on sugar as it was, until the following year.

At length the long deferred claims of sugar obtained a hearing; and in April, 1864, the following important alterations and reductions were made in the duties:—Refined sugar reduced from 18s. 4d. to 12s. 10d. per cwt.; clayed to white clayed from 16s. to 12s. 8d. per cwt.; white clayed to brown clayed from 13s. 10d. to 10s. 6d. per cwt.; Muscovado ditto from 12s. 8d. to 9s. 4d. per cwt. And a new class of inferior sugars for the Dutch numbers, not rising above No. 6, 8s. 2d. per cwt. Duty on molasses, 3s. 6d. per cwt., melado, 6s. 7d. per cwt. These rates were imposed as a permanent act, as contra-distinguished from duties leviable from year to year.

RAW SUGAR under No. 13 Dutch Standard:—

	French or Foreign Vessel, per 100 kilo net.		Above No. 13 to 20 inclusive.	
From French West Indies, and Island of Réunion	37 fr. to	39 fr.	39 fr. to	41 fr.
From other French Colonies	37	—	39	—
Other Countries, out of Europe ...	42	44	44	46
From Europe or European Entrepots, Colonial or Beet Sugar	44	44	46	46
WHITE SUGAR powdered above Dutch Standard No. 20:—				
From French West Indies and Island of Réunion	40 fr. to 42 fr.			
From other French Colonies	40			
White powdered Sugar from all other countries is prohibited.				
REFINED SUGAR:—				
From French West Indies and Island of Réunion	42 fr. to 44 fr.			
From other French Colonies	42			
From England and Belgium, with Certificate of origin, in French, English, or Belgian ships, or per Land Carriage	55 fr. to 60 fr. 20 c.			
CANDY from Belgium, with Certificate of origin, in French or Belgian ships, or per Land Carriage	58 fr. to 63 fr. 40 c.			

Refined Sugar from elsewhere, not mentioned above, prohibited.

BEET-ROOT SUGAR, grown and manufactured in France, is charged 42 fr. below No. 13 Dutch Standard, 44 fr. from No. 13 to 20; Powdered White above No. 20 45 fr., and Refined 47 fr. per 100 kilo.

The Detax levied on French Colonial Sugars conforms to the above table, and will be maintained until the 1st of January, 1870; from that date sugars of Colonial origin will pay the same duty as native sugar, viz.—42 fr. for sugars below No. 13 in quality, and 44 fr. for those between Nos. 13 and 20 inclusive.

The Surtax de Pavillion, a law on the mercantile shipping, is now limited to three years' duration. T

double-decime is now included in the principal, consequently there is but one rate of duty.

The drawbacks allowed on refined sugar taken for export are according to the following scale.

Made of Raw Sugar under No. 10.	In Titlers, Loaves, and Candy, per	78 kilo.
	Crushed and White Lumps	79
From No. 10 to 13 inclusive.	Titlers, Loaves, and Candy	80
	Crushed and White Lumps	81
From No. 13 to 16 inclusive.	Titlers, Loaves, and Candy	83
	Crushed and White Lumps	84

A drawback is allowed equal to the original import duty on 100 kilos of the above mentioned Standard, but only such sugars are admitted to be refined for exportation as have been imported direct by sea from countries out of Europe.

A low description of sugar called by refiners "Bastards," equal to No. 13, may be exported at the proportion of 105 kilo Bastards to 100 kilo raw.

French currency—25 French, 20s. English.

In Belgium raw sugar from

	Duty.	Excise.
All parts of the world is charged	1 fr. 20 c.	45 fr. per 100 kilos
But home-grown and manufactured		45
Refined Sugar according to general tariff		114
From Countries which are under a Commercial Treaty with Belgium		63
Ditto ditto with France		60
Drawbacks allowed for Export		
On Candy approved of by the Customs		58
Refined, best quality, Loaves or Crushed		53 50 c.
Ditto inferior quality		45

Belgium Currency—25 fr. 20s. English.

In Holland the duties on raw and beet-root sugar foreign or home-grown are 22 fl. for 100

RAW SUGAR under No. 13 Dutch Standard:—

	French or Foreign Vessel, per 100 kilo net.		Above No. 13 to 20 inclusive.	
From French West Indies, and Island of Réunion	37 fr. to 39 fr.		39 fr. to 41 fr.	
From other French Colonies	37	—	39	—
Other Countries, out of Europe ...	42	44	44	46
From Europe or European Entrepots, Colonial or Beet Sugar	44	44	46	46
WHITE SUGAR powdered above Dutch Standard No. 20:—				
From French West Indies and Island of Réunion	40 fr. to 42 fr.			
From other French Colonies	40			
White powdered Sugar from all other countries is prohibited.				
REFINED SUGAR:—				
From French West Indies and Island of Réunion	42 fr. to 44 fr.			
From other French Colonies	42			
From England and Belgium, with Certificate of origin, in French, English, or Belgian ships, or per Land Carriage	55 fr. to 60 fr. 20 c.			
CANDY from Belgium, with Certificate of origin, in French or Belgian ships, or per Land Carriage	58 fr. to 63 fr. 40 c.			

Refined Sugar from elsewhere, not mentioned above, prohibited.

BEET-ROOT SUGAR, grown and manufactured in France, is charged 42 fr. below No. 13 Dutch Standard, 44 fr. from No. 13 to 20; Powdered White above No. 20 45 fr., and Refined 47 fr. per 100 kilo.

The Detax levied on French Colonial Sugars conforms to the above table, and will be maintained until the 1st of January, 1870; from that date sugars of Colonial origin will pay the same duty as native sugar, viz.—42 fr. for sugars below No. 13 in quality, and 44 fr. for those between Nos. 13 and 20 inclusive.

The Surtax de Pavillion, a law on the mercantile shipping, is now limited to three years' duration. The

double-decime is now included in the principal, consequently there is but one rate of duty.

The drawbacks allowed on refined sugar taken for export are according to the following scale.

Made of Raw Sugar under No. 10.	In Titlers, Loaves, and Candy, per	78 kilo.
	Crushed and White Lumps	79
From No. 10 to 13 inclusive.	Titlers, Loaves, and Candy	80
	Crushed and White Lumps	81
From No. 13 to 16 inclusive.	Titlers, Loaves, and Candy	83
	Crushed and White Lumps	84

A drawback is allowed equal to the original import duty on 100 kilos of the above mentioned Standard, but only such sugars are admitted to be refined for exportation as have been imported direct by sea from countries out of Europe.

A low description of sugar called by refiners "Bastards," equal to No. 13, may be exported at the proportion of 105 kilo Bastards to 100 kilo raw.

French currency—25 French, 20s. English.

In Belgium raw sugar from

	Duty.	Excise.
All parts of the world is charged	1 fr. 20 c.	45 fr. per 100 kilos
But home-grown and manufactured ...	... ...	45
Refined Sugar according to general tariff	... ...	114
From Countries which are under a Commercial Treaty with Belgium		63
Ditto ditto with France	... ...	60
Drawbacks allowed for Export		
On Candy approved of by the Customs	... ...	58
Refined, best quality, Loaves or Crushed	... ...	53 50 c.
Ditto inferior quality	... ...	45

Belgium Currency—25 fr. 20s. English.

In Holland the duties on raw and beet-root sugar either foreign or home-grown are 22 fl. for 100

	French or Foreign Vessel, per 100 kilo net.		Above No. 13 to 20 inclusive.	
RAW SUGAR under No. 13 Dutch Standard:—				
From French West Indies, and Island of Réunion	37 fr. to	39 fr.	39 fr. to	41 fr.
From other French Colonies	37	—	39	—
Other Countries, out of Europe ...	42	44	44	46
From Europe or European Entrepots, Colonial or Beet Sugar	44	44	46	46
WHITE SUGAR powdered above Dutch Standard No. 20:—				
From French West Indies and Island of Réunion	40 fr. to	42 fr.		
From other French Colonies		40		
White powdered Sugar from all other countries is prohibited.				
REFINED SUGAR:—				
From French West Indies and Island of Réunion	42 fr. to	44 fr.		
From other French Colonies		42		
From England and Belgium, with Certificate of origin, in French, English, or Belgian ships, or per Land Carriage	55 fr. to	60 fr. 20 c.		
CANDY from Belgium, with Certificate of origin, in French or Belgian ships, or per Land Carriage	58 fr. to	63 fr. 40 c.		

Refined Sugar from elsewhere, not mentioned above, prohibited.

BEET-ROOT SUGAR, grown and manufactured in France, is charged 42 fr. below No. 13 Dutch Standard, 44 fr. from No. 13 to 20; Powdered White above No. 20 45 fr., and Refined 47 fr. per 100 kilo.

The Detax levied on French Colonial Sugars conforms to the above table, and will be maintained until the 1st of January, 1870; from that date sugars of Colonial origin will pay the same duty as native sugar, viz.—42 fr. for sugars below No. 13 in quality, and 44 fr. for those between Nos. 13 and 20 inclusive.

The Surtax de Pavillion, a law on the mercantile shipping, is now limited to three years' duration. The

double-decime is now included in the principal, consequently there is but one rate of duty.

The drawbacks allowed on refined sugar taken for export are according to the following scale.

Made of Raw Sugar under No. 10.	In Titlers, Loaves, and Candy, per	78 kilo.
	Crushed and White Lumps	79
From No. 10 to 13 inclusive.	Titlers, Loaves, and Candy	80
	Crushed and White Lumps	81
From No. 13 to 16 inclusive.	Titlers, Loaves, and Candy	83
	Crushed and White Lumps	84

A drawback is allowed equal to the original import duty on 100 kilos of the above mentioned Standard, but only such sugars are admitted to be refined for exportation as have been imported direct by sea from countries out of Europe.

A low description of sugar called by refiners "Bastards," equal to No. 13, may be exported at the proportion of 105 kilo Bastards to 100 kilo raw.

French currency—25 French, 20s. English.

In Belgium raw sugar from

	Duty.	Excise.
All parts of the world is charged	1 fr. 20 c.	45 fr. per 100 kilos
But home-grown and manufactured ...	... ...	45
Refined Sugar according to general tariff	... ...	114
From Countries which are under a Commercial Treaty with Belgium	... ...	63
Ditto ditto with France	... ...	60
Drawbacks allowed for Export		
On Candy approved of by the Customs	... ...	58
Refined, best quality, Loaves or Crushed	... ...	53 50 c.
Ditto inferior quality	... ...	45

Belgium Currency—25 fr. 20s. English.

In Holland the duties on raw and beet-root sugar either foreign or home-grown are 22 fl. for 100

CHAPTER X.

SUGAR DUTIES OF FOREIGN COUNTRIES.

BEFORE quitting this subject I may here note the import sugar duties of America, France, Belgium, Holland, the Zollverein, and Russia.

In America, raw sugar, not above No. 12, Dutch standard, 3 cts. per lb.; above No. 12, and including No. 15, 3½ cts. per lb.; No. 15, not stove dried, and not above No. 20, 4 cts.; refined loaf, lump, or quality above No. 20, 5 cts.; candy, 10 cts. per lb.; treacle, 2½ cts. per lb., and molasses, 8 cts. per gallon. An extra 10 per cent. is added to the above duties, if imported in foreign ships not under treaty with the United States.

In France, the duties on sugar, refined and unrefined, with drawbacks allowed on refined sugar for export, are according to recent treaties as follows:—

RAW SUGAR under No. 13 Dutch Standard:—

	French or Foreign Vessel, per 100 kilo net.		Above No. 13 to 20 inclusive.	
From French West Indies, and Island of Réunion	37 fr. to	39 fr.	39 fr. to	41 fr.
From other French Colonies	37	—	39	—
Other Countries, out of Europe ...	42	44	44	46
From Europe or European Entrepots, Colonial or Beet Sugar	44	44	46	46

WHITE SUGAR powdered above Dutch Standard No. 20:—

From French West Indies and Island of Réunion	40 fr. to 42 fr.
From other French Colonies	40

White powdered Sugar from all other countries is prohibited.

REFINED SUGAR:—

From French West Indies and Island of Réunion	42 fr. to 44 fr.
From other French Colonies	42
From England and Belgium, with Certificate of origin, in French, English, or Belgian ships, or per Land Carriage	55 fr. to 60 fr. 20 c.
CANDY from Belgium, with Certificate of origin, in French or Belgian ships, or per Land Carriage	58 fr. to 63 fr. 40 c.

Refined Sugar from elsewhere, not mentioned above, prohibited.

BEET-ROOT SUGAR, grown and manufactured in France, is charged 42 fr. below No. 13 Dutch Standard, 44 fr. from No. 13 to 20; Powdered White above No. 20 45 fr., and Refined 47 fr. per 100 kilo.

The Detax levied on French Colonial Sugars conforms to the above table, and will be maintained until the 1st of January, 1870; from that date sugars of Colonial origin will pay the same duty as native sugar, viz.—42 fr. for sugars below No. 13 in quality, and 44 fr. for those between Nos. 13 and 20 inclusive.

The Surtax de Pavillion, a law on the mercantile shipping, is now limited to three years' duration. The

double-decime is now included in the principal, consequently there is but one rate of duty.

The drawbacks allowed on refined sugar taken for export are according to the following scale.

Made of Raw Sugar under No. 10.	In Titlers, Loaves, and Candy, per	78 kilo.
	Crushed and White Lumps	79
From No. 10 to 13 inclusive.	Titlers, Loaves, and Candy	80
	Crushed and White Lumps	81
From No. 13 to 16 inclusive.	Titlers, Loaves, and Candy	83
	Crushed and White Lumps	84

A drawback is allowed equal to the original import duty on 100 kilos of the above mentioned Standard, but only such sugars are admitted to be refined for exportation as have been imported direct by sea from countries out of Europe.

A low description of sugar called by refiners "Bastards," equal to No. 13, may be exported at the proportion of 105 kilo Bastards to 100 kilo raw.

French currency—25 French, 20s. English.

In Belgium raw sugar from

	Duty.	Excise.
All parts of the world is charged	1 fr. 20 c.	45 fr. per 100 kilos
But home-grown and manufactured		45
Refined Sugar according to general tariff		114
From Countries which are under a Commercial Treaty with Belgium		63
Ditto ditto with France		60
Drawbacks allowed for Export		
On Candy approved of by the Customs		58
Refined, best quality, Loaves or Crushed		53 50 c.
Ditto inferior quality		45

Belgium Currency—25 fr. 20s. English.

In Holland the duties on raw and beet-root sugar either foreign or home-grown are 22 fl. for 100

kilo net. Refined, 36 fl.; Treacle, 8 fl.; and Milado or Molasses with more than 10°/₀ of crystallizable sugar, 15 fl.; with less than 10°/₀, 4 fl. Drawbacks on Candy for export are 30 fl. 12 c. Loaf and crushed, 26 fl. 86 c., and Bastards, 32 fl. per 100 kilo net.

Dutch currency—1 Guilder, 1s. 8d. English 100 cents.

In the Zollverein Sugar duties are levied as follows:—

	Per Zollverein cwt. (110 lbs. English.) thlrs.	sgr.
Refined Lump Sugar, crushed or powdered Candy	7	10
Raw Sugar or Pieces	6	—
Ditto only to be used in home Refineries under certain conditions...	4	7½
Treacle	2	15
Home Refined, Manufactured of Foreign Sugar ... ... Drawbacks allowed.	4	22½
Refined Beet-root and Candy, or Refined Colonial Sugar which does not comc in as above in quantities not under 10 cwt. net	3	10
Raw Beet-root Sugar and Pieces in quantities not under 30 cwt....	2	22½

From the 1st Sept. 1866, the last two will be 3 thlrs. 15 sgr. net, and 2 thlrs. 26 sgr.

German (Zollverein) Currency 1 thlr. (3s. English), 30 gros., 12 pfennige.

In Russia the duty is, for raw or powdered sugar, 2 silver rbls., 50 kops. per pud, if per land carriage, but if per sea, 2 rbls., 75 kops.; refined, in loaves

crushed or candy, 3 rbls. per land carriage, and 4 rbls., 50 kops. per sea; all but the above descriptions, are prohibited. One silver rbl. represents 3s. 2d. English; and a pud about 36 lbs. weight.

There is a probability in 1867 of the rates per sea being reduced to 3 rbls. on refined, and 1½ rbls. on raw in 1869.

CHAPTER XI.

THE CONSUMPTION OF RAW SUGAR IN THE UNITED KINGDOM DURING THE PERIOD FROM 1701 TO 1864, AND OF REFINED AND SUGAR CANDY FROM 1844 TO 1864, INCLUSIVE. WITH BRIEF NOTES, ON THE CONSUMPTION IN AMERICA, FRANCE, RUSSIA, AUSTRIA, SPAIN, AND PORTUGAL.

THE quantity of raw sugar consumed in England was inconsiderable until tea and coffee came into use, both of these being introduced towards the end of the seventeenth century; its use commenced from this period to be general. In 1700 the quantity consumed in England was about 10,000 tons, or about 22,000,000 lbs.; and in 1710 14,000 tons, or 31,360,000lbs.

From 1731 to 1780 the annual consumption of sugar was as follows:—

Years.	Cwts.
1731	722,445
1732	700,940
1733	899,510

Years.	Cwts.
1734	650,747
1735	833,740
1736	819,022
1737	510,121
1738	814,815
1739	887,924
1740	639,803
1741	817,674
1742	681,179
1743	744,008
1744	666,213
1745	472,052
1746	642,523
1747	556,523
1748	866,141
1749	805,313
1750	807,471
1751	782,167
1752	789,389
1753	958,371
1754	816,304
1755	1,072,305
1756	832,994
1757	1,138,423
1758	914,707
1759	1,030,066

Years.	Cwts.
1760	1,202,614
1761	1,128,013
1762	1,120,821
1763	1,350,456
1764	1,246,890
1765	1,074,467
1766	1,372,480
1767	1,313,347
1768	1,382,929
1769	1,282,935
1770	1,577,171
1771	1,254,926
1772	1,569,826
1773	1,571,569
1774	1,777,414
1775	1,640,698
1776	1,478,140
1777	1,207,097
1778	1,324,140
1779	1,378,337
1780	1,221,795

For the next ten years the consumption rapidly increased, and in 1790 it reached 1,620,000 cwts.

Some singular fluctuations will be observed in the foregoing table. Thus, in 1734 the quantity of sugar consumed was nearly 250,000 cwt. less than

in the preceding year. The year 1737 exhibits a falling off of upwards of 300,000 cwt. from its predecessor; 1740, a falling off of nearly 250,000 cwt., and 1756 and 1758, each a diminution of upwards of 200,000 lbs. Notwithstanding these temporary interruptions, however, it will be seen how enormously the consumption increased during sixty years.

From 1790 onwards the consumption was as follows:—

Years.	Cwts.
1791	1,403,211
1792	1,361,592
1793	1,677,097
1794	1,489,392
1795	1,336,230
1796	1,554,062
1797	1,273,722
1798	1,476,552
1799	2,772,438
1800	1,506,921
1801	2,773,795
1802	2,250,311
1803	1,492,565
1804	2,144,369
1805	2,076,103
1806	2,801,747

Years.	Cwts.
1807	2,277,665
1808	2,842,813
1809	2,504,507
1810	3,489,312
1811	3,226,757
1812	2,604,019
1813	2,209,063
1814	1,997,999
1815	2,211,299
1816	2,592,931
1817	3,298,941
1818	1,726,896
1819	2,820,900
1820	2,901,864

From the years 1809 to 1814 inclusive, sugar used in distilleries is included in the computation. At various times during that period corn for distillation was prohibited. Apart from this, the same eccentricities of consumption may be observed as before. Thus, in the year 1800 a falling off was apparent from its predecessor of upwards of 1,200,000 lbs.; in 1803 nearly 800,000 lbs.; and in 1818, 1,500,000 lbs., or nearly one half the total consumption! Nevertheless, the final result is in the same ratio as the previous sixty years.

From the year 1820 to 1840 the following consumption is shown:—

Years.	Cwts.
1821	3,056,882
1822	2,989,057
1823	3,228,991
1824	3,367,424
1825	3,079,848
1826	3,573,990
1827	3,340,927
1828	3,601,419
1829	3,539,821
1830	3,722,044
1831	3,781,011
1832	3,655,534
1833	3,651,804
1834	3,741,579
1835	3,856,562
1836	3,488,399
1837	3,954,810
1838	3,909,665
1839	3,825,599
1840	3,594,834

From the year 1840 onwards the consumption was:—

Years.	Cwts.
1841	4,057,628
1842	3,868,466
1843	4,028,307
1844	4,129,443
1845	4,856,624
1846	5,220,248
1847	5,779,508
1848	6,142,296
1849	5,905,687
1850	6,091,492
1851	6,233,547
1852	6,898,867
1853	7,272,833
1854	8,028,758
1855	7,259,148
1856	6,813,470
1857	7,121,590
1858	8,490,256
1859	8,641,920
1860	8,506,882
1861	8,937,302
1862	9,111,622
1863	9,202,523
1864	8,937,313

It is to be borne in mind that the foregoing tables represent the *quantities retained for home*

consumption only. The gross imports during the same years will be found in another portion of this work.

It is only within the past twenty years that refined sugar has taken any prominent position in statistical records. The following tables of the quantity imported from British possessions and of foreign manufacture, with the quantity and declared value of British refined exported, will illustrate the gradual increase of one and decade of the other. The imports from 1844 to 1851 are most observable for their rapid increase, but from that period the weight decreased in round numbers 40,000 cwts., and remained about stationary to the end of 1863. During this period the exports of British refined had averaged, annually, about 200,000 cwts., with a declared average in value of about £350,000. per annum. The reduction of duty which came into operation on the 7th May, 1864, had a most striking effect on both imports and exports, as will be seen on reference to the tables, that the former *increased* more than three hundred per cent., whilst the latter *decreased* to a like amount. The reduction made at this date upon refined sugar was from 18s. 4d. to 12s. 10d. per cent.

Refined sugar and sugar candy retained for actual consumption from 1844 to 1864, inclusive :—

Years.	Of British Possessions. Cwts.	Foreign. Cwts.
1844	—	6
1845	—	56
1846	4,798	13,610
1847	9,335	16,795
1848	20,925	25,266
1849	59,860	15,277
1850	15,046	101,289
1851	35,924	302,155
1852	5,052	268,939
1853	10,942	203,814
1854	9,975	293,674
1855	10,112	277,897
1856	1,444	256,601
1857	377	297,551
1858	326	255,914
1859	781	241,598
1860	605	264,509
1861	909	242,769
1862	1,280	266,917
1863	1,267	249,004
1864 To 16 April / From 16 Ap.	4,924	794,420

The quantity and declared value of British renned sugar exported from the United Kingdom in the years 1844 to 1864, respectively :—

Years.	Quantity. Cwts.	Declared Value. £.
1845	273,776	472,947
1846	227,570	392,404
1847	229,186	413,437
1848	248,702	437,221
1849	223,273	373,721
1850	209,148	344,499
1851	258,726	368,085
1852	213,563	300,134
1853	179,254	301,627
1854	125,139	218,351
1855	43,881	99,916
1856	313,953	806,445
1857	119,830	355,635
1858	127,260	362,472
1859	119,996	342,088
1860	84,722	235,798
1861	141,659	348,763
1862	213,507	531,609
1863	278,757	504,958
1864	119,571	199,841

The consumption of sugar in America appears to be almost, if not quite, as large as that of England. It is difficult to arrive at the exact figures, but from the best attainable information

it was, for ten years previous to the war between North and South, as follows:—

Years.	Cwts.
1850	5,410,000
1851	5,779,700
1852	6,306,240
1853	7,462,115
1854	7,705,840
1855	7,555,029
1856	7,575,237
1857	5,615,319
1858	7,769,840
1859	7,830,562

In France the total consumption is not nearly so great as that of England or America. Great quantities of beet-root sugar are consumed there, and the annual consumption of foreign sugar can scarcely be estimated at more than 3,000,000 cwts.

In Russia duty is paid on about 30,000 tons of raw sugar, but considerable quantities are said to be smuggled into the country, and at a rough estimate the consumption may be taken at about 1,000,000 cwts.

Austria and Germany are supplied through Holland, the Hanse Towns, and the ports on the south shore of the Baltic and Trieste. Most part of

the produce of the Dutch colonies is imported into Holland, and considerable quantities are also imported from other countries, so that the total imports into the Dutch ports are probably about 120,000 tons per annum; the imports into Hamburg and Bremen average 45,000 tons a year; and those into Antwerp, 20,000 tons. The imports into the Austrian dominions are about 35,000 tons.

The consumption of sugar in Spain is about 40,000 tons, and that of Portugal about 12,000 tons.

The most interesting points to observe in the consumption of sugar are the impetus which the reduction of the duties has given to this branch of commerce, and the extraordinary increase in the amount individually consumed.

The circumstance that first claims attention is, that during the long term of years intervening between 1800 and 1844, *the consumption of sugar was stationary*, or rather retrograding considering the increase of population, it being in 1800 seventeen millions, and in 1844 twenty-seven millions. The fourteen years of almost uninterrupted war with which the century opened shows the average quantity consumed by each person to have been 18 lbs. 7 oz. annually; and in the following thirty years of peace it only amounted to 17 lbs. 3 oz.

The following observations were made by John Messinger, Esq., for the Select Committee appointed in 1862, to inquire into the operation of the sugar duties:—"That the rate of consumption should have been higher in the earlier than in the latter interval seems difficult at first of comprehension; but it must be remembered that the period of the war, unfavourable as it doubtless was to any healthy or regular development of the national resources, was yet a period of continued lavish expenditure on the part of the Government, and of frequently renewed commercial excitement. Such a state of things has an obvious tendency to increase the consumption of all articles that minister to the daily wants or enjoyments of the working classes.

"It may further be remarked that, although during the war the prices of commodities were generally high, and all the higher for being estimated in a depreciated currency, the market value of sugar was lower then, on the whole, than it subsequently was for some years after the restoration of peace. We may affirm, indeed, that the virtual monopoly secured to our colonies in the supply of the home market,—a monopoly so burdensome afterwards to the mother country,—was felt far less injuriously at a time when the population of the United Kingdom was less by [illegible] eleven millions than it is at

present, when the power of production in the West India Islands was maintained at a high pitch by the employment of slave labour, and when the exportation of British refined sugar, though fostered by an extravagant bounty, was forcibly held in check by the political condition of the European continent.

"But when the ports of the Continent were thrown open, an eager demand arose for those tropical products, the use of which had been for some years virtually and even formally interdicted to the people of almost every country but our own. Whatever raw sugar of foreign growth had been accumulated in our bonded warehouses was now speedily withdrawn for exportation; and besides this, the sugar of our own colonies, after having undergone the process of refining, by which it became entitled to the 'bounty,' was shipped in large quantities to the Hanse Towns, the Baltic, Antwerp, Rotterdam, and the Mediterranean.

"Under the operation of a system which repressed competition in the supply, and encouraged competition in the demand, it is not to be wondered at that the consumption of sugar fell off. Thus, from 1801 to 1814 the average quantity consumed by each individual of the population was less in the later than in the earlier period by about 2¼ lbs. per annum.

"After 1819, however, an altered state of affairs began to manifest itself. The Continent was now abundantly and cheaply supplied with the sugar of Cuba, and Brazil, and other foreign territories, both in America and Asia; and though the exportation of British refined sugar was still kept under by the sheer force of the bounty, the vacuum thus caused in the home supply was filled by continually increasing importations from Mauritius and from British India. During the whole quarter of a century, however, intervening between 1819 and 1845, the consumption of sugar was characterised by nothing like buoyancy or expansion. The quantity consumed by each individual of the population never, in any two successive years of that period, exceeded the mean of 19 lbs., and on the entire period it scarcely reached the average of 18 lbs. Moreover, in the last ten years of the term it had sensibly fallen off. It was apparent, in short, that the price of sugar in this country was still too high in relation to the value of labour, and that a free use of the article by the working classes was only to be brought about by some decided course of legislation, throwing open fresh and abundant sources of supply."

The reductions of the duty in 1844 and 1845 had an immediate and great effect; the consumption

of unrefined and refined in 1844 was 4,129,449 cwts.; in 1845 it rose to 4,856,680 cwts.; in 1846 to 5,238,656 cwts. The further lowering of the duties in 1847 and 1848 was followed by results equally as marked: the consumption in 1847 was 5,805,638 cwts.; in 1848 it reached 6,188,487 cwts.;—showing a regular increase of consumption during four years of nearly 103,000 tons, equal to about 50 per cent. advance upon the quantity consumed in 1844. During the same period the increase in the individual consumption may be set down as from 17 lbs. to 23 lbs. per head.

It is worth recording, to show the worthlessness of predictions, when founded on false data and narrow prejudices, that the Protectionists maintained that the reduction of the duties would bring about no perceptible increase in the consumption of sugar. And Lord George Bentinck, the champion of the sugar monopolists, went the length of showing, that under no conceivable circumstances could the people consume more than 5,600,000 cwts. of sugar in the course of a year! In the third year after the prophecy was issued, namely, 1848, the total consumption of raw and refined sugar rose to 6,188,487 cwts.

The provision of the equalisation of the duties

finally took effect in 1854. It then appeared, on looking back to the period preceding the Act of 1845, that in the intermediate space of ten years the rate of consumption had been exactly doubled, having risen from 17 lbs. to 34 lbs. per head.

In 1854, when, owing to the Russian war, the sugar duties were increased, the consumption per head then fell from 34 lbs. to 30 lbs. in 1855, and to 28 lbs. in 1856. In 1858, the large supplies induced a higher rate of consumption, which rose to 34 lbs. per head. Since then the consumption has continued to increase, and the statistics of 1864 show the quantity retained for home consumption for that year to have been 9,736,657 cwts., or in round numbers, 486,833 tons; and the individual consumption about 42 lbs. per head.

APPENDIX.

SUGAR PACKAGES.—The packages generally used for the exporting of sugar may be thus enumerated—hogsheads, tierces, barrels, bags, mats, baskets, and boxes. All West Indian sugars are shipped in hogsheads, tierces, and barrels, the hogsheads from Porto Rico being the smallest, and those from Trinidad and Barbadoes the largest. The clayed sugar of Cuba, called Havannah from the name of the principal port of shipment, is packed in boxes weighing from 4 to 5 cwt. each. Most of the Brazil crop is packed in cases or chests, weighing from 12 to 16 cwt., but the more manageable form of bags weighing about 1½ cwt. is now superseding the unwieldy boxes. Mauritius sugar is shipped in double bags or mats, the inner one made of cotton or a similar fabric, and the outer mat composed of strong reeds of cane, and

weigh about 1¼ cwt. each. East India sugar is supplied in double bags weighing about 2 cwt. each, the inner one fine and the outer one made of a coarse material called in Mincing-lane gunny bag. Java sugar is packed in baskets weighing from 4 to 6 cwt. each.